THE SAN FRANCISCO BAY AREA

Its Problems and Future

VOLUME II

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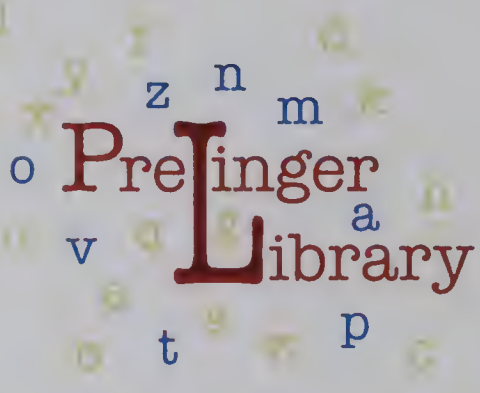

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INSTITUTE OF GOVERNMENTAL STUDIES
University of California · Berkeley, California
DWIGHT WALDO, *Director*

THE SAN FRANCISCO BAY AREA

Its Problems and Future

Edited by
STANLEY SCOTT, *Assistant Director*

FRANKLIN K. LANE VOLUME TWO
1966

FOREWORD

The Institute of Governmental Studies is pleased to present this volume bringing together seven of the Franklin K. Lane monographs dealing with the problems and future of the San Francisco Bay Area. The series takes its name from Franklin Knight Lane (1864–1921), a distinguished Californian who was successively New York correspondent for the San Francisco Chronicle, City and County Attorney of San Francisco, member and later Chairman of the U.S. Interstate Commerce Commission, and Secretary of the Interior in the Cabinet of President Woodrow Wilson.

Shortly after Mr. Lane's death, a group of friends arranged for the establishment of a fund to be held and invested by Herbert Hoover, Adolph C. Miller and Franklin D. Roosevelt for the benefit of Mr. Lane's widow during her lifetime, and thereafter for some purpose to perpetuate his memory. In 1939, the three trustees acted to create the Franklin K. Lane Memorial Foundation at the University of California, Berkeley. The general purposes of the foundation are to promote "better understanding of the nature and working of the American system of democratic government, particularly in its political, economic and social aspects," and the "study and development of the most suitable methods for its improvement in the light of experience."

In 1958, when the incumbent Chancellor, Clark Kerr, now President of the University, moved to allocate income from the fund to the Bureau of Public Administration (now the Institute of Governmental Studies), it was agreed that the study of Bay Area problems and policy questions should be one of the research efforts to receive support. The seven monographs contained herein were previously issued as separate publications of the Institute of Governmental Studies, along with others included in this Lane project.

I express my gratitude to the many contributors to the series, most but not all of whom are colleagues here on the Berkeley campus. Finally, I would like to thank Stanley Scott, Assistant Director, who originated and administered the project, and served as editor.

DWIGHT WALDO
Director

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KINGSLEY DAVIS AND ELEANOR LANGLOIS

FUTURE DEMOGRAPHIC GROWTH . . .

Future Demographic Growth of the San Francisco Bay Area

INSTITUTE OF GOVERNMENTAL STUDIES
University of California • Berkeley, California
DWIGHT WALDO, Director

Future Demographic Growth of the San Francisco Bay Area

BY
KINGSLEY DAVIS
and
ELEANOR LANGLOIS

International Population and Urban Research

(Grateful acknowledgement is made to Andrew Collver of the Staff of IPUR for his work on the projections used in this paper.)

1963

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The Need for a Bay Area Model

When thinking of a city's growth, one normally thinks in terms of population. Yet cities almost never grow in population alone, but grow also in territory. A model of city growth, if it is to approximate reality, and especially if it is to be used for prediction, must therefore be a two-variable model—that is, one in which both population and area are allowed to change. When data on city growth are obtained or studied, they must include information on territorial as well as demographic expansion. Without the simultaneous consideration of both variables, our notion of city growth is distorted.

Although this principle may seem obvious, it has seldom been practiced. The standard approach to the growth of "cities" and "metropolitan" areas has been to "hold boundaries constant." Indeed, not to hold boundaries constant has been regarded as a source of error. Warren Thompson, in his study of the growth of metropolitan districts from 1900 to 1940, was at great pains to make his comparisons only for "identical areas."[1] Donald Bogue, who studied the growth of standard metropolitan areas from 1900 to 1950, also dealt with constant areas.[2] He recognized the distortion in doing so in particular cases, but he did not see it as a basic problem in principle.[3]

The distortion is compounded when one talks about the *components* of metropolitan areas, such as central cities, rings, and fringes. To talk about these as if they were fixed territorial entities with merely changing populations has been standard procedure. In view of the difficulty of defining "central cities" in purely ecological rather than in political terms, and of finding data over time that will enable one to delimit a changing center and a changing fringe and outer boundary, the use of this fixed-territory procedure is certainly understandable. We have found it hard to avoid with respect to the Bay Area, as will be seen. Nevertheless, any conclusions concerning the changing internal distribution of the population within metropolitan areas must be drawn only with the artificiality of the fixed areas in mind.

Amos Hawley, who dealt with all the metropolitan areas in the

[1] Warren S. Thompson, *The Growth of Metropolitan Districts in the United States: 1900–1940,* Washington: Government Printing Office, 1947.

[2] Donald Bogue, *Population Growth in Standard Metropolitan Areas: 1900–1950,* Washington: U. S. Housing and Home Finance Agency, 1953. See also his *Components of Change in Standard Metropolitan Areas,* Oxford, Ohio: Scripps Foundation, 1957.

[3] In the 1953 study just cited, Bogue says (p. 10): "This extension backward of 1950 boundaries to earlier censuses is most valid for the large and least valid for the small SMA's. It is questionable whether such an extension would yield meaningful results in cases where the total population of the area is less than 100,000."

United States, and who consequently could not have done otherwise than take fixed areas for the components, drew partially erroneous conclusions from his extremely interesting findings. Analyzing the growth of population in concentric zones from 1900 to 1950, he came to the conclusion that metropolitan populations were "concentrating" from 1900 to 1920 and "deconcentrating" after that—a conclusion suggested in the title of his impressive book reporting the findings.[4] This result, which we do not find for the Bay Area complex, was in our view an artifact of his constant boundaries. He used only units that were "comparable" in area over time, pushing back to 1900 the central cities, the standard metropolitan areas, and the extended metropolitan areas of 1950. (The "extended metropolitan areas" included all counties with centers within 35 miles of the core of the central city.)

Hawley's inference of concentration rests on the fact that in 1900–20 the central city populations grew faster than the satellite-area populations (i.e., the people in all the territory surrounding the center out to 35 miles and over). But the central cities were not necessarily central cities that far back: they may well have been whole metropolitan areas in themselves, including sizable portions of unoccupied or rural land. Furthermore, the territory outside the central city was not homogeneous in character: in most cases it was mainly farmland in 1900, hence was losing population to the urbanized area by rural-urban migration—whereas by 1940 it was heavily fringe land and hence was gaining by urban deconcentration. The possibility that the population of the fixed-boundary central city was spreading out *within* that entity in the early part of the century, plus the fact that Hawley's data on the remainder of the metropolitan areas show a wave of population growth spreading outward in time, both strongly suggest that deconcentration was occurring throughout the 1900–50 period rather than only after 1920.[5] In the case of the Bay Area, without being able to adjust the "central city" boundaries as realistically as we should like, we find that deconcentration was occurring after 1890.

The danger of using fixed boundaries in studying urban growth is recognized by the practice of the Census Bureau. If the researcher, instead of complaining that the bureau changes its definitions from time to time, would ask himself why a change of definition is necessary, he would see that growth of territory is as important as the growth of population in understanding urban change. The "metropolitan districts" recognized in the 1910 Census were small in territory compared

[4] Amos Hawley, *The Changing Shape of Metropolitan America: Deconcentration Since 1920,* Glencoe, Illinois: The Free Press, 1956.

[5] For a slightly fuller critique, see Kingsley Davis's review of Hawley's book in *American Journal of Sociology* 63: 429–430, January 1958.

to the later ones. The 1910 district was limited in extent both by density and distance criteria—in most cases the density of territory included had to be at least 150 per square mile and the distance could not be more than ten miles from the central city. In 1930 the ten-mile limit was dropped. In 1950 the "metropolitan district" concept was replaced by two new types of unit—the "urbanized area" and the "standard metropolitan area." The latter area, which included entire counties as its component units, was substantially larger than the former "metropolitan district." In 1960 the metropolitan delimitations, which were given the name "standard metropolitan statistical area," used criteria similar to those on which the 1950 SMA's were based. These criteria allowed for the addition to the area of new counties as they attained metropolitan status. Thus the Census Bureau was trying to keep up with reality by expanding the territorial boundaries of its metropolitan units. The progression can be seen in the case of the San Francisco-Oakland metropolitan area, as follows:

Year	Name of unit	Area[a] (square miles)
Metropolitan concept		
1910	Metropolitan district	452
1920	Metropolitan district	448
1930	Metropolitan district	826
1940	Metropolitan district	1,003
1950	Standard metropolitan area	3,314
1960	Standard metropolitan statistical area	3,314
Urbanized concept		
1950	Urbanized area	287
1960	Urbanized area	572

[a] The areas for 1910–40 are from Warren S. Thompson, *op. cit.*, p. 31; for 1950–60 from United States Census, *U. S. Summary, Number of Inhabitants*, 1950, pp. 1-28 and 1-75; 1960, pp. 1-47 and 1-112.

The official effort to keep up with the territorial expansion of the Bay Area urban entity has been genuine though spasmodic. It can doubtless be improved by a detailed study of the area, but in any case the fact of territorial expansion cannot be ignored if we wish to approximate reality.

By contrasting the size of the territory comprised in the "urbanized area" with that included in the "standard metropolitan statistical area," one can see that most of the metropolitan area was made up of rural land in 1950 and 1960. If this was true so late in the history of the Bay Area, how much truer must it have been in 1910 or 1920! To take the metropolitan boundaries of 1950 and treat them as fixed all the way back to 1910, and then to deal with population increase in that un-

changing territory, is to misunderstand the process of change. As late as 1945, no less than 64 percent of all the land in the six counties comprising the 1950 standard metropolitan area was in farms, and much of the rest was purely rural.

In analyzing the past growth of the Bay Area in order to get some notion of possible future trends, we shall therefore use a two-variable model of the "metropolitan area" rather than a single-variable model, in order to follow changes in both territory and population.

Past Growth of the Bay Area Metropolis

Our method for determining past growth was to utilize historical data on the area and population of towns and civil divisions in the Bay Area region, going back to 1850. At any census date when an area met our criteria for inclusion in the metropolitan area, it was added. By consolidating the units we could thus obtain the population and the area of the total metropolis at successive dates. By grouping the units according to their location and other characteristics, we could form a conception of the changing area and population of the "central city," the "suburban ring," the "fringe," etc. By dividing the area into the population, we could study the changing density of the metropolitan area as a whole, and of its component parts.

The first step was to determine the population of the towns and civil divisions. In the earlier years we sometimes found confusion as to exactly which political unit the population given in the Census referred to. But since the population figures for each place could be compared from one Census to another, the nature of the unit in question could usually be determined with some confidence.

Having determined the populations as accurately as possible, we had next to decide when each community should be added to the metropolitan area (MA). In making this decision in each case, we considered both the community's location and what evidence we could find of its integration with other communities already included in the MA. Our intention was to add units which were contiguous either to the central city or to another part already included in the metropolitan area, but this criterion was not strictly adhered to. Communities separated from the MA by 10 or 15 miles were occasionally added when evidence of their integration seemed to justify it. For instance, we included San Rafael in 1900, although it did not adjoin the MA, because the commuting service between San Francisco and Marin County had been improved during the previous decade. If a community was either too far from the MA or there was no appearance of integration, however, we postponed its admission. According to this principle, although San Rafael had over 3,000 people in 1890, we did not add it until the following census year because transportation services to San Francisco appeared to be irregular. And, although Vallejo had 6,000 people in 1880, and by 1920 had over 20,000, it was not added until 1950, when successive territorial additions had sufficiently diminished its distance from other places already included in the MA.

Finding the area of each of the places at the time of each census year

presented a more difficult problem, for area figures are available—especially for some of the smaller places—at a few census dates only. When necessary, therefore, the area of a place was inferred from data for a later year. In other words, the first area figure we could find for a particular town or civil division was considered to apply for all earlier years as well—thereafter the area of that place was held constant until a new figure showed that it had changed. As a result, the MA's territory may be somewhat overstated in the early years, but as annexations became frequent, the territory may have been temporarily understated. In some cases, of course, these errors cancelled each other out.

Political units were added when their population seemed to be urban (in terms of the size, density, and economy of the place) and to be connected with the central city or other parts of the MA. Thus some of the territory of these units was doubtless rural when they were first added. This is particularly true after 1930, when we began to add minor civil divisions as well as cities and towns. The places newly included in the MA usually had small populations in relation to area, and thus added more proportionately to the land area of the MA than they did to the population. Thus, although we gave new territory to the MA so freely in 1950 that the area increased by 126 percent over the previous census year, the population of the MA grew only by 57 percent. Strictly speaking, some of the rural land included in 1950 was urban ten years later. For this reason there would be a certain logic to smoothing the line representing the land area in order to eliminate the pronounced irregularities. This has not been done in discussing either the rate of territorial growth or changes in density, but it has been taken into consideration in making projections.

This delimitation procedure gave us the area and population figures shown in Table 1. The procedures necessarily involved judgment as to when any particular unit should be added, and a certain amount of inaccuracy was inevitable. Appendices A and B give the names, areas, and populations of each place at the time the place was first included in our expanding metropolitan area. This will help the reader to form his own critical judgment as to the validity of our results.

It can be seen from Table 2, as well as from Charts 1 and 2, that the growth-rate of the MA's population appears smoother than the growth of its area. This is doubtless due in part to the difficulties of maintaining a consistent basis of delimitation throughout the period covered. The smoothness of the population growth can be seen from the fact that, for the decades after 1870, the standard deviation from the mean growth-rate was only 17 percent whereas in the case of the territorial growth it was 40 percent.

Focusing on population growth, we see that in the early years the very high rate of increase reflected the opening up of the West in general. San Francisco did not appear at all in the Census of 1840, being Mexican territory. By 1860 it had over 50,000 people, and this figure more than doubled in the following decade, even without the addition of the several East Bay communities which we considered to be within

TABLE 1

AREA AND POPULATION OF THE IPUR SAN FRANCISCO BAY METROPOLITAN AREA, 1852–1960

Year	Area (square miles)	Population (thousands)
1852	42[a]	34.5
1860	42	56.8
1870	56	163.2
1880	56	274.3
1890	65	364.0
1900	83	450.7
1910	151	670.3
1920	165	881.2
1930	215	1,266.7
1940	304	1,375.3
1950	685	2,153.3
1960	1,286	3,216.7

[a] In 1852, the earliest population figure we have for San Francisco, the official area was probably less than 42 square miles.

the MA at that time. From 1870 until the turn of the century the rate of population growth became slower each decade. Between 1900 and 1940 there was no consistent pattern to the rate of growth. Finally, from 1940 to 1960 there was a resumption of steady growth at a fast pace. The slack period of the 1930's—when the rate of population increase in the Bay Area and everywhere else was lower by far than for any other decade in our history—was followed by the wartime influx of people and the post-war baby boom, which combined to produce the highest rate of population growth since the 1870's.

By contrast, territorial expansion of the Bay Area was very slow in the early years. Much of the population growth took place within San Francisco itself, of course, for much of the western portion of the city was almost unoccupied until well into the twentieth century (Twin Peaks tunnel was not built until 1918). Between 1900 and 1910 a large increase in the territory of the MA occurred, principally as a result of

TABLE 2

INCREASE IN AREA AND POPULATION BY DECADES, 1852–1960

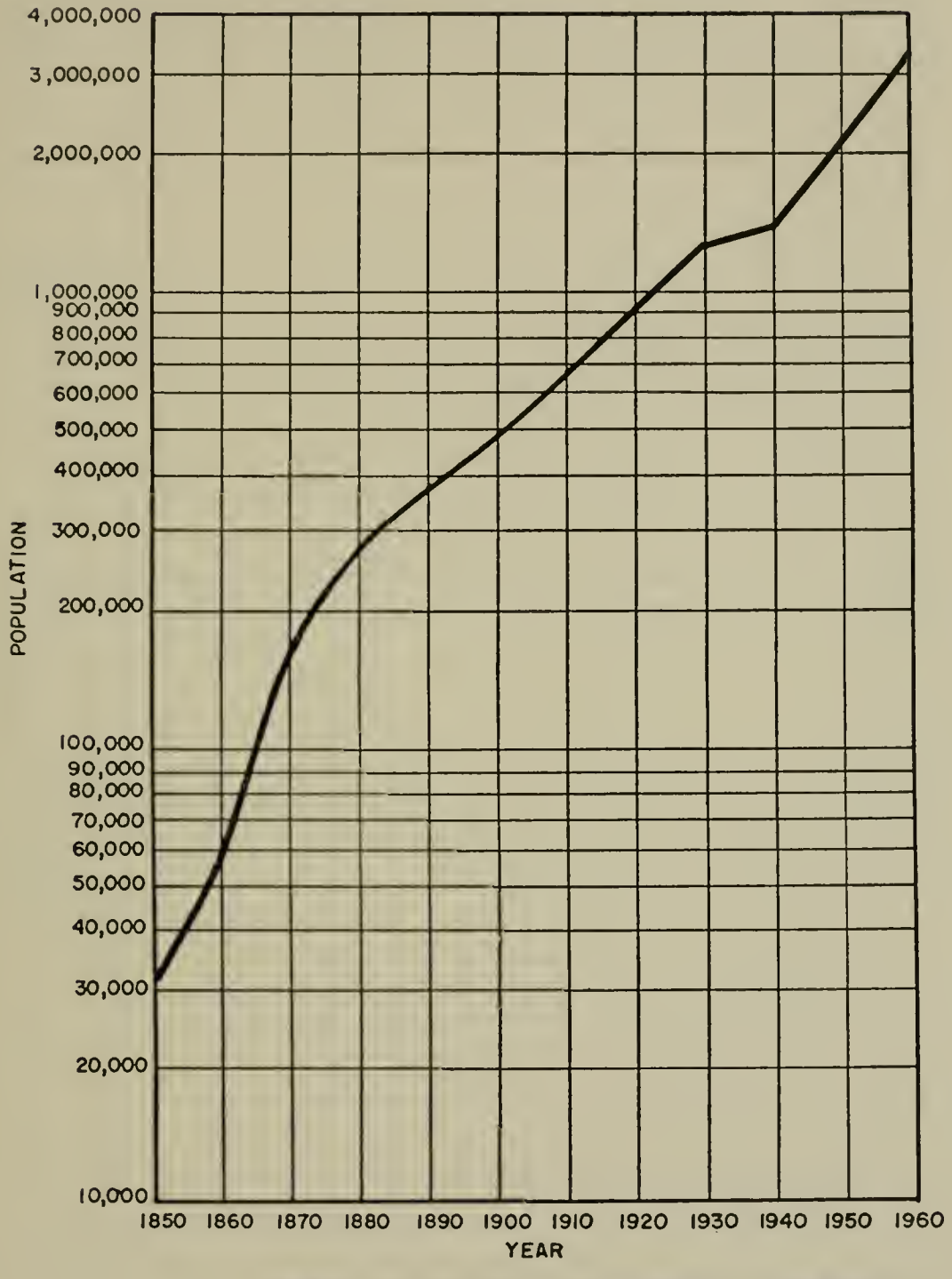
Decade	Percent increase in area	Percent increase in population
1852–60	none	63.3
1860–70	33.1	187.3
1870–80	none	68.1
1880–90	15.4	32.7
1890–1900	29.0	23.8
1900–10	81.3	48.7
1910–20	9.5	31.5
1920–30	30.3	43.7
1930–40	41.1	8.6
1940–50	125.5	56.6
1950–60	87.8	49.4

SOURCE: Table 1.

the annexation by the City of Oakland of more than thirty square miles.

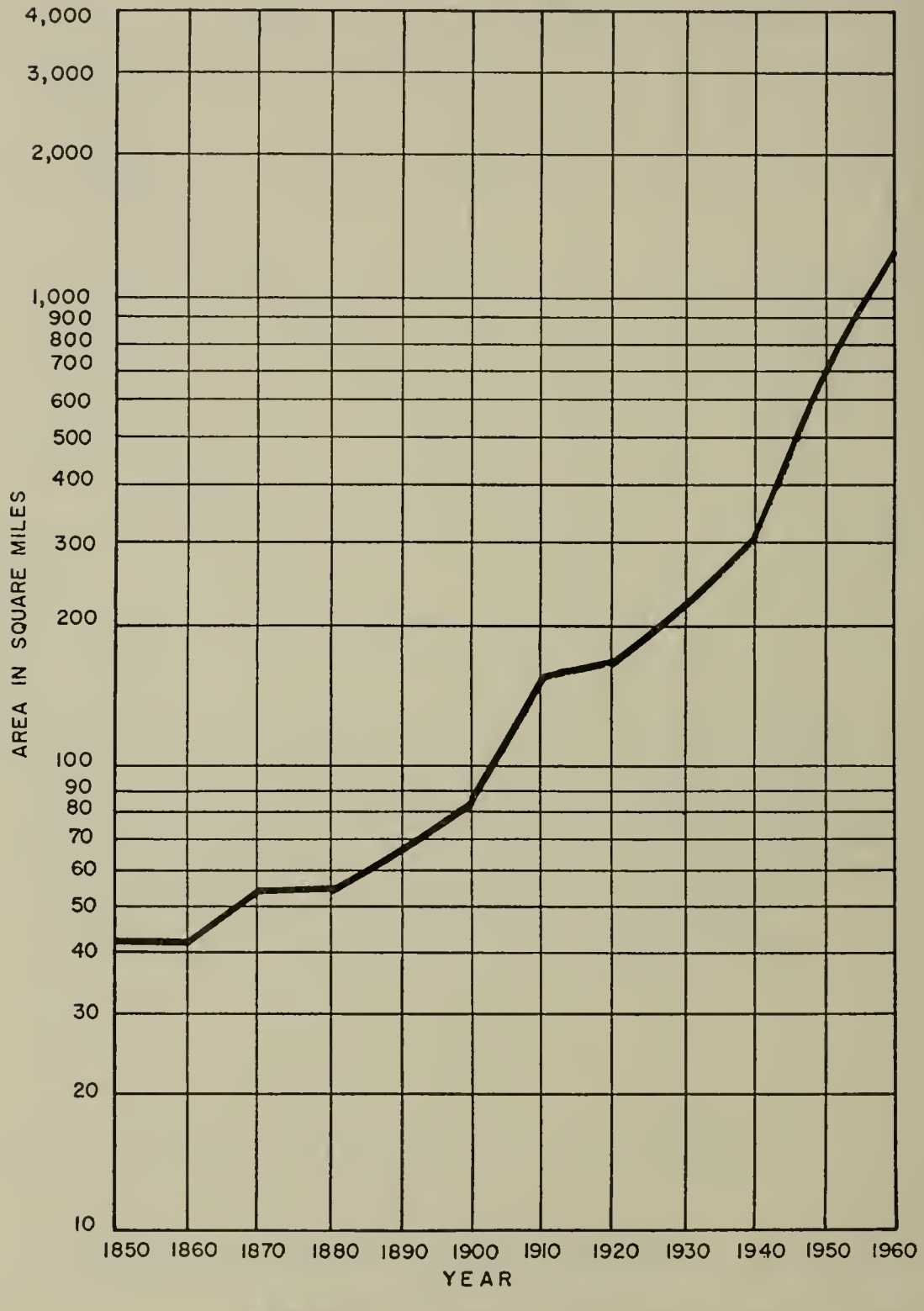
The small increase in territory in the following decade is probably—as was the case in San Francisco—a matter of growth taking place within Oakland itself. We note that in the year 1900, the population density in Oakland had been over 5,000 per square mile, but ten years later, although the population had more than doubled, the density of the city was only 3,300. In the 1920's the rate of area growth for the MA was again what it had been in the decade before the annexation. The really significant change in territorial growth came in the 1940's and 1950's, when the flight to the suburbs was in full swing.

CHART I. POPULATION OF THE EXPANDING BAY AREA METROPOLITAN COMPLEX 1850 TO 1960



SOURCE: INTERNATIONAL POPULATION AND URBAN RESEARCH

CHART 2. TERRITORY COVERED BY THE EXPANDING BAY AREA METROPOLITAN COMPLEX 1850 TO 1960



SOURCE: INTERNATIONAL POPULATION AND URBAN RESEARCH

Population Density and Its Changes

In the changing San Francisco Bay metropolitan area as we have delimited it, the average population density, never very great as urban densities go, went through a cycle. Beginning at a low figure, the population per square mile rose rapidly until 1880, rounded off to a fluctuating plateau from 1890 to 1930, and decreased rapidly after that (see Table 3). The 1960 density was down to approximately what it had been about 95 years previously.

This cycle may seem surprising. We think back to 1870 as a period of simplicity in urban life, particularly in frontier California, and conclude that urban density must have been slight. The truth is, however, that because the level of living and the efficiency of urban transportation were lower than they are today, people were huddled together more than they would be today in a town with the same number of inhabitants. Indeed, our figures probably understate the degree of crowding in the nineteenth century. In 1870 much of the land within the boundaries of the City and County of San Francisco was as yet unoccupied. If we were to take three fourths of the present area of the city as a basis for computing the density in 1870, the figure for that date would be 5,000 per square mile. The actual proportion of the land that was occupied probably came to much less than three fourths. Therefore, the "cycle" of change in average density may be an artificial result of our difficulty in determining the actual amount of land devoted to urban settlement. However, there can be no doubt that the population per square mile has been declining rapidly since 1930. The enormous increase in population has been more than matched by a fantastic expansion of the territory covered by the MA, thus lowering the average density of settlement.

Of course, the lowering of the average density has not represented so great a change as the increase of the total area over which the density is spread. The people crowded together in the San Francisco–Oakland MA in 1880 numbered only 274,000. They probably did not *feel* very crowded, because they were surrounded by countryside, and the countryside seemed readily accessible. The people in the MA today number 3½ million, and there can be no doubt that they feel crowded. They feel this way, not because of their average density, which is low, as we have seen, but because this density is spread over a total area that has become more than twice the size of the State of Rhode Island and considerably larger than the State of Delaware. We are thus using our resources and our high level of production to put ever more millions of

TABLE 3

POPULATION PER SQUARE MILE, 1852–1960, AND PERCENT CHANGE FOR EACH DECADE

Year	Population per square mile	Percent change
1852	829[a]	..
1860	1,352	+ 63
1870	2,919	+120
1880	4,907	+ 68
1890	5,643	+ 15
1900	5,417	− 4
1910	4,445	− 22
1920	5,334	+ 20
1930	5,883	+ 10
1940	4,528	− 28
1950	3,145	− 31
1960	2,501	− 21

[a] Assuming 1860 boundaries.

people into the hills and valleys of an ever-expanding fringe zone in our metropolitan agglomerations. The result is a very low density from which escape is increasingly difficult, because the population is spread so far.

It should be noted that we are talking about *residential* population densities. The working—daytime—population is of course considerably more concentrated than the residential population, but to a degree it has also followed the pattern of rapid total growth and even more rapid spatial dispersion.

Concentration and Deconcentration

Since 1930 the San Francisco Bay metropolitan area, as we have delimited its changing outer boundaries, has been rapidly deconcentrating in the sense that the territory of the MA has grown more rapidly than the population, with a consequent lessening of density. From 1880 until about 1930 there was no apparent trend one way or another, although a part of the apparent stability may be a function of our delimitation methods. In any case, we may call this post-1930 drop in density a case of "over-all deconcentration," because it deals with the average density of the MA as a whole. There is, however, an additional question: Has there been a tendency for the population to distribute itself more evenly *within* the MA? This question relates to the equality or inequality of population density among the parts or bands of the MA. If the bands have been becoming more nearly equal in population density, we can say that "internal deconcentration" has been taking place. Unfortunately, this method of measuring "deconcentration" has not been generally utilized. Before dealing with this method in connection with our MA, however, the more usual method will be examined first.

A common way of analyzing changes in the internal population distribution of metropolitan areas has been to take the central city as a fixed area and to subtract it from the total MA (also fixed in extent). The remainder is then called the "ring" (again with unchanging boundaries). If the ring's population has grown faster than that of the central city, this is interpreted as "deconcentration," and the opposite is "concentration." The fallacy of this procedure has already been alluded to.[6] As long as one is reasoning in terms of fixed boundaries, the picture of concentration and deconcentration will depend more on the varying unreality of the boundaries than on anything else. For example, in Table 4 we show the changing population and density of the central cities, on the one hand, and *of the remainder* of the six counties com-

[6] In the case of the Bay Area, the greatest error would arise from the assumption that the MA boundaries remained fixed. In 1870, e.g., the six counties constituting in 1960 the officially defined San Francisco-Oakland standard metropolitan statistical area were predominantly in farms, pastures, and wasteland. Eighty-nine percent of the population of 53,000 outside the central cities was rural. Since the rural population in the U. S. was being depleted by migration to the cities, we could expect the "ring," as defined by these boundaries, to show a slower growth than the "central cities." This was the case for a while. Between 1870 and 1890, for instance, the gain in the "ring" was 95 percent, while that in the "central cities" (whose boundaries did not change was 117 percent. After 1900 the "ring" had become much more urban, hence was drawing rural-urban migrants as well as losing them.

TABLE 4

BAY AREA COUNTIES: CENTRAL CITY VERSUS RING, BY AREA AND POPULATION DENSITY

Year	San Francisco			Oakland			San Francisco and Oakland	Ring[a]	
	Population (thousands)	Area (square miles)	Density	Population (thousands)	Area (square miles)	Density	Density	Population (thousands)	Density[b]
1852.....	34.8	42.0	829	.....	....	.....	829	.....	...
1860.....	56.8	42.0	1,352	.....	....	.....	1,352	27.9	9
1870.....	149.5	42.0	3,560	10.5	7.4	1,419	3,239	52.6	16
1880.....	234.0	42.0	5,571	34.6	7.4	4,676	5,437	79.4	24
1890.....	299.0	42.0	7,119	48.7	7.4	6,581	7,038	102.8	31
1900.....	342.8	42.0	8,162	67.0	12.7	5,276	7,492	133.1	41
1910.....	416.9	42.0	9,926	150.2	45.7	3,287	6,466	206.9	64
1920.....	506.7	42.0	12,064	216.3	45.7	4,733	8,244	286.6	89
1930.....	634.4	42.0	15,105	284.0	53.2	5,338	9,647	429.3	133
1940.....	634.5	44.6	14,226	302.0	52.8	5,720	9,615	525.3	163
1950.....	775.4	44.6	17,386	385.5	53.0	7,274	11,894	1,079.9	336
1960.....	740.3	47.6	15,553	367.5	53.0	6,934	11,012	1,675.5	522

[a] Obtained by subtracting the combined population of Oakland-San Francisco from that of the six counties comprising the standard metropolitan statistical area. The six counties are Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Solano.

[b] The total area of the six counties is 3,313 square miles. When the combined area of San Francisco and Oakland is subtracted from this, we have the territorial extent of the ring.

posing the standard metropolitan statistical area, on the other. It can be seen that the "ring," as thus defined, has never failed to gain in density. Since its population per square mile has risen rapidly, while that in the central cities has risen slowly (and reversed itself slightly from 1950 to 1960), one may say that the SMSA has undergone "deconcentration" since 1880.

This result, however, applies to the constant area comprising the six counties now designated as the SMSA. Does it also apply to our expanding MA? The answer, as shown in Table 5, is equivocal: the density of the "ring" rose from 1910 to 1930, fell from 1930 to 1950, and rose from 1950 to 1960. Because the central cities generally gained in density but did so slowly, the net effect was that the fluctuations in the ring determined the question of internal concentration or deconcentration within the MA, as measured by comparing the two component areas. The last column in Table 5, which shows the ratio of central city density to ring density, is the index of this two-component gradient. It shows a general trend of concentration throughout the period from 1870 to 1960, with reversals in 1880, 1930, and 1960. This finding is clearly at odds with that for the SMSA.

Since the San Francisco Bay metropolitan area, as we have delimited it from one census date to another, has grown in territory and population more rapidly than the central cities, the latter have necessarily come to represent a diminishing proportion of the total complex. The figures showing this are given in Table 6, where the central cities are shown as a proportion of the total MA. Both the population and the territory expanded faster outside than inside the central cities. Of the two variables, however, it was the territory that expanded more rapidly. At about 1925 the point was reached where the central cities comprised less than half the total territory of the MA, but they still held about 78 percent of the population. It was not until about 1950 that the central cities ceased to contain more than half of the MA's total population. Bearing in mind that the daytime population is more heavily concentrated in the central cities than the residential population, we can see that the central cities, if they have lost dominance vis-a-vis the remainder of the Bay Area (a dubious proposition in itself), have done so only recently.

So much emphasis is put on the movement of people to the suburbs and the "plight" of the central business district, that one is in danger of imagining the central cities to be ever more depopulated. Such is far from the case. As Table 4 shows, the area of the central cities has grown more slowly than their population, with the consequence that their population density has generally risen rather than fallen. The "loss" of

TABLE 5

THE IPUR METROPOLITAN AREA:
CENTRAL CITY VS. RING, BY AREA AND DENSITY

Year	Central cities population per square mile	Ring			Ratio: Central city density to ring density
		Area[a] (square miles)	Population[a] (thousands)	Population per square mile	
1852.....	829	.....	.....	.....	....
1860.....	1,352	.....	.....	.....	....
1870.....	3,560	13.9	13.7	986	3.61
1880.....	5,571	13.9	40.3	2,899	1.92
1890.....	7,119	22.5	65.0	2,889	2.46
1900.....	8,162	41.2	107.9[b]	2,619	3.12
1910.....	6,466	63.1	103.2	1,635	3.95
1920.....	8,244	77.5	158.2	2,041	4.04
1930.....	9,647	120.1	348.3	2,900	3.33
1940.....	9,615	206.3	438.8	2,127	4.52
1950.....	11,894	587.1	992.4	1,690	7.04
1960.....	11,012	1,185.4	2,108.9	1,779	6.19

[a] For the delimitation of the whole metropolitan area, see Appendix A. The "ring" was obtained by subtracting the central cities from the total.
[b] Oakland was made a central city by IPUR as of 1910, thus removing it from the "ring" at that date.

TABLE 6

THE CENTRAL CITIES AS A PERCENTAGE OF THE TOTAL TERRITORY AND POPULATION OF THE METROPOLITAN AREA

Year	Percentage of area	Percentage of population
1852.....	100	100
1860.....	100	100
1870.....	75	92
1880.....	75	85
1890.....	65	82
1900.....	50	76
1910.....	58	85
1920.....	53	82
1930.....	44	73
1940.....	32	68
1950.....	14	54
1960.....	8	34

SOURCE: Data in Tables 1 and 4. The discontinuity between 1900 and 1910 is produced by the fact that Oakland is included in the central city by us for the first time in 1910. Internal analysis of the settlement pattern within both San Francisco and Oakland would show a smoother trend in the early decades, because a substantial part of both areas was not built up. However, the general trend is shown adequately by treating each central city as a whole.

the central cities is therefore relative, not absolute. Even the relative loss is exaggerated by the fact that we are dealing with residential rather than work-place population. As the center of commerce and business, there is no evidence as yet that the central cities of the Bay Area are "emptying out."

It is true, however, that the central cities, like the central cities of almost all other metropolitan areas in the nation, are maintaining their absolute resident population by attracting migrants who have a low income and who therefore live in crowded housing conditions. The more their populations are made up of these migrants—who in San Francisco and Oakland come from the southern states, Mexico, eastern and southern Europe and Asia—the more crowded they will be. The fact that the central cities in the Bay Area had a slight loss in residential population between 1950 and 1960—thus reversing a long trend—does not necessarily mean less per-acre residential crowding in 1960, because the residential situation depends on the changing extent to which central-city land is being used for commercial purposes.

Future Growth of the Metropolitan Area

In order to be consistent in our two-dimensional conception of the San Francisco Bay metropolitan area, we must deal with its projected growth in terms of both population and territory. Nearly all city "projections" have been made in terms of population, with either no mention of territory or an assumption of a fixed territory. We shall attempt to treat each one separately, but with the fact in mind that both are expanding. Then we shall combine the two elements to gain a notion of future trends in density.

Projected Population Growth

One method of estimating the future population of an urban complex is to examine its past population change and to assume that this is part of a longer curve or line that extends into the future. In other words, the urban complex is taken as a unit in itself, and its past trends are extrapolated into the future. In the case of the San Francisco Bay metropolitan area, we have seen that past population growth describes a reasonably smooth curve. When the logarithmic values are plotted against time, the curve approximates a straight line, and extrapolation of this line yields an estimated population as follows:[7]

Year	Population[a] (thousands)
1970	3,820
1980	4,944
1990	6,368
2000	8,130

[a] These figures do not appear in Table 6, which summarizes the projections. The reason for this is that Table 6 gives "high" and "low" estimates, not "medium" ones. The figures on this page are the populations given by the straight-line extrapolation, and the "high" and "low" figures based on this method are obtained by taking the average deviation on each side of the line.

In other words, according to this calculation, in the year 2000 the Bay Area metropolis will contain about half as many people as the New York metropolis contains today. Those who are now adults may take comfort that they will probably never live to see the Bay Area reach the present condition of Gotham's human ocean.

[7] The formula used is:

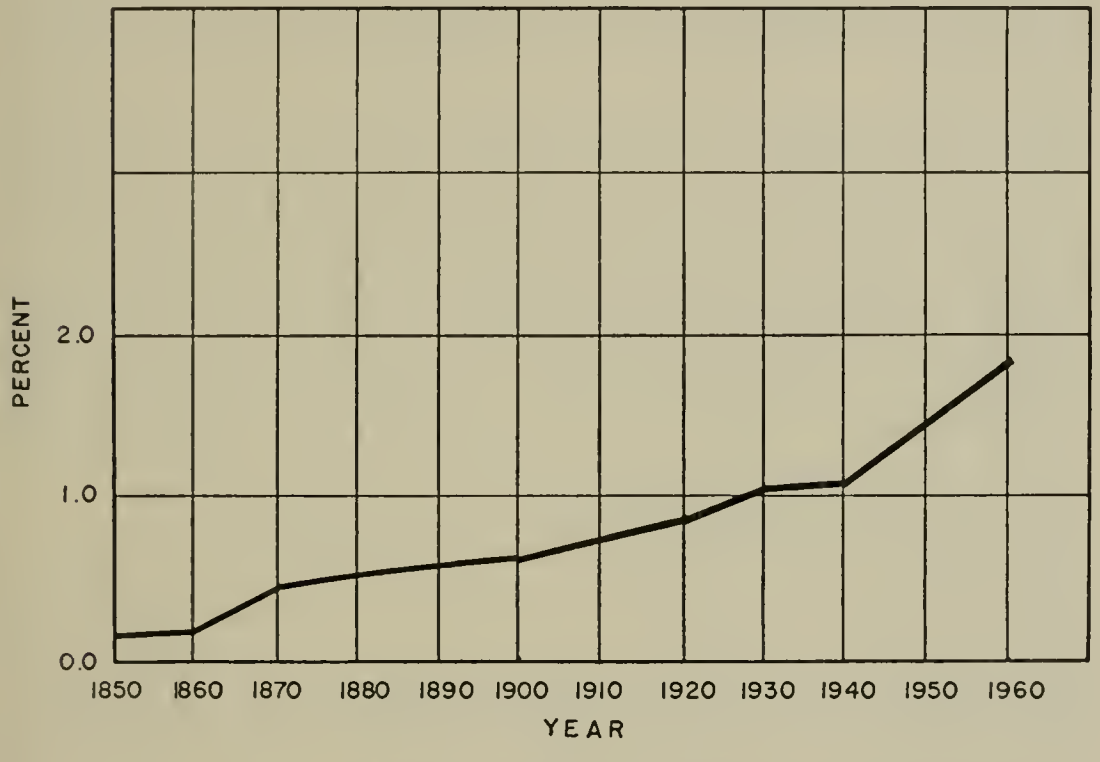
$$\log P_c = \log P_o + aT^n$$

where "P_c" is the calculated population, "P_o" the starting population, "T" the time in decades, and "a" and "n" are constants. For our population data, with the population of 1852 as the starting point, a good fit is given by:

$$\log P_c = \log P_o + .39T^{.67}$$

The trouble with treating the Bay Area complex as an independent unit is that it is not independent. The Bay Area is an integral part of the state's and the nation's economy. Accordingly, another way to project the area's population is to examine the history of the ratio of the MA's population growth to the nation's and the state's growth. If a consistent trend can be established in the ratios, these can be projected forward, and official projections of the state's or the nation's

CHART 3. PROPORTION OF THE U.S. POPULATION LIVING IN THE EXPANDING BAY AREA METROPOLITAN COMPLEX



SOURCE: INTERNATIONAL POPULATION AND URBAN RESEARCH

population can then be used to estimate the future population of the Bay Area metropolitan complex. This procedure has the great advantage of relying upon larger units—the state and the nation—which, by virtue of their size, represent safer bets for future population estimates.

Beginning with the United States, we find that the percentage of the nation's population included in the San Francisco Bay metropolitan area has shown a long upward trend (see Chart 3). This trend has shown no tendency to decelerate during 110 years. In fact, between 1940 and 1960 the proportion increased at better than the average rate. This

brings us to the sort of dilemma that faces every long-run population projector. If we assume that the Bay Area's proportion of the U. S. population will continue to increase at the same average per-decade rate exhibited during the past eleven decades, and if we take a fairly bold projection of the U. S. population, we find that in the year 2000 the population of the metropolitan area will be 18.8 million.[8] This figure does not appear in our projections (Table 7) because it strikes us as improbable. We reason that the West is filling up—that as it does so the westward migration will dwindle—hence the growth of the Bay Area's proportion of the national total population will slacken, or that the nation's population growth will approach the slow northwest European pattern in this century. This, however, is strictly *a priori* reasoning. There is nothing in the data to indicate that the 18.8 million figure will not actually be reached, much as our minds recoil from imagining it.

On the other hand, if we assume that the Bay Area's proportion of the national population will lie on a straight line fitted by least-squares to the previous proportion, and if we take a conservative projection of the U. S. population,[9] the Bay Area estimate for the year 2000 is only 6.6 million. This figure appears in Table 7 as the lowest projection for the century's end. The extremely wide discrepancy illustrates the imponderables in such long-run estimates. It does not illustrate all of the imponderables, for there may be *nobody* here at the close of the century. But it shows the extreme limits of what seems possible, given *some* kind of continuation of past trends.

Still another basis of projection is to view the Bay Area complex in relation to the State of California. In this case, as Chart 4 shows, the population of the metropolitan area *declined* in ratio to the state's population during most of the period, although there is a slight rise in the ratio from 1940 to 1960. A straight line fitted to the figures has about as much rationale as any other kind of line. Projecting this line—that is, assuming the ratio to the state's population to continue to decrease at an accelerating rate—gives us a low estimate when the ratio is multiplied by the estimated future population of the state. The figure for

[8] The projected U. S. population used in this instance is 380.8 million for the year 2000. This figure is taken from U. S. Department of Commerce, Office of Area Development, *Future Development of the San Francisco Bay Area, 1960–2020,* Washington, D. C.: Government Printing Office, 1959, p. B-3. The proportion in the San Francisco Bay metropolitan area at that time, assuming a constant per-decade increase in the proportion, would be .0495 percent.

[9] The U. S. population estimate used in this case is 331.8 million by the end of the century. This is based on "high" data in the United Nations projections (see sources in Table 7).

TABLE 7

Population Projections for the IPUR Metropolitan Area

(millions)

Basis on Which Projection is Made

Year	Past growth of MA alone[b]		Ratio of MA to U. S.[c]		Ratio of MA to California[d]	
	High	Low	High	Low	High	Low
1960[a]	3.2	3.2	3.2	3.2	3.2	3.2
1970	4.3	3.4	4.9	3.5	4.6	4.1
1980	5.5	4.4	7.7	4.5	6.7	5.3
1990	7.1	5.6	11.2	5.5	9.7	6.7
2000	9.1	7.2	16.4	6.6	14.2	8.2

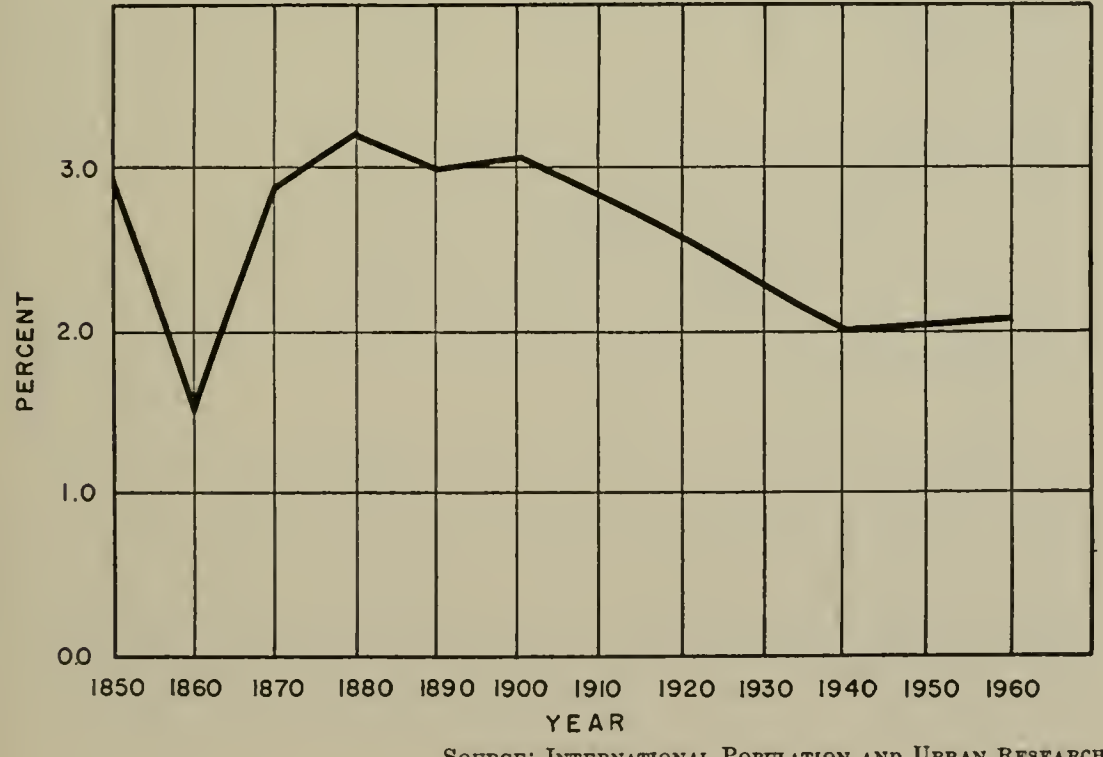
[a] Actual census population of the San Francisco metropolitan area as delimited by IPUR.

[b] The projection of Bay Area growth is based on the formula, $\log P_t = \log P_o + .39T^{.67}$, where P_t and P_o are the calculated and starting populations and T is time counted in decades from 1850. The high and low estimates are derived by applying the average deviation from the line (11.5 percent of the line-value) of actual populations in the past.

[c] The United States projected population for 1970 and 1980 is taken from the high figures given in United States Bureau of the Census, Current Population Reports, *Population Estimates* (Series P-25, No. 251, July 6, 1962). Those for 1990 and 2000 are derived from the United Nations, *Future Growth of World Population*, New York: United Nations, 1958, pp. 70, 72, by assuming that the percentage of Northern America represented by the United States in the projection for 1975 would remain constant until 2000. The high estimates are produced by increasing the MA's ratio to the United States constantly at the average rate exhibited over the past. The low estimates come from assuming a constant reduction in the ratio as shown by a straight line fitted to the previous ratios.

[d] The high estimates are made by assuming a constant rate of increase such as that exhibited in the past with little deviation, and assuming that the MA's population continues to bear the same ratio to the state's population (20 percent) that it exhibited approximately in 1950 and 1960. The low estimate is made by the state's population and a progressive drop in the ratio of the MA population to that of the state in conformity with a straight line fitted to the previous ratios, taking the Census Bureau's estimates of the state's future population, as given in U. S. Office of Area Development, *Future Development of the San Francisco Bay Area, 1960–2020*, Washington, D.C.: U. S. Government Printing Office, 1959, p. B-3 and by assuming a progressive drop in the ratio of the MA population to that of the state in conformity with a straight line fitted to the previous ratios.

Chart 4. Proportion of California's Population Living in the Expanding Bay Area Metropolitan Complex



Source: International Population and Urban Research

the year 2000 turns out to be 8.2 million. If, on the other hand, we assume that the ratio—which has remained virtually fixed during three censuses—is now stabilized, and if we also assume a constant rate of growth of the state's population, we wind up with an estimate of 14.2 million in the year 2000.

Table 7 summarizes the high and low population projections for each of the three different approaches. There is no way of saying which figures are the "best"; about all that can be said is that the farther our projections extend into the future, the less probable any of them become. Naturally, the bases of projection compensate for this fact, because as the future time is extended, the difference between the high and low estimates, the "fan" as it is called, becomes wider. If we average all the projections for each date, we come out with the following:

Year	Average of high estimates	Medium estimate or general average	Average of low estimates
	millions	*millions*	*millions*
1960	3.2	3.2	3.2
1970	4.6	4.1	3.7
1980	6.6	5.7	4.7
1990	9.3	7.6	5.9
2000	13.2	10.3	7.3

The "high" estimates are obtained by averaging the three "high" columns in Table 7; the "low" estimates by averaging the "low" columns; and the general average, or "medium," estimates by averaging *all* the columns for each date. Absolutely no extra credence should be given to these averages. The "fan" between the average high and average low estimates increases as follows:

PERCENTAGE BY WHICH AVERAGE HIGH PROJECTION EXCEEDS AVERAGE LOW PROJECTION

1970	24
1980	40
1990	58
2000	81

With regard to the probability of the projections, two important considerations must be borne in mind: First, the projections are all made on the assumption that past growth will not be interrupted in some catastrophic fashion. If thermonuclear warfare were to kill half the United States population, or if the country were conquered by China and one fourth of the Chinese population were added to ours, the projections would not hold (and of course *we* would not be worrying about them anyway). Second, the future estimates of the San Francisco Bay metropolitan area *refer to an expanding territory*. They should neither be applied to the present territory of the metropolitan area nor be compared with projections which relate to a fixed territory. The most systematic projections previously published—those made by the United States Office of Area Development—were for the area covered by nine counties.[10] These same counties were grouped together by the Stanford Research Institute,[11] although they were split into three areas by Warren Thompson.[12] The difference between this unchanging nine-county region and our growing metropolitan area can be seen by making some comparisons, as is done in Table 8.

Throughout the entire period from 1880 to 1960, the population of the IPUR area grew faster than that of the nine-county area. The projections call for a continuance of this discrepancy, with the result that by 1980 the IPUR territory will have caught up with the nine-county territory in population, even though it will still include only 59 percent as much land-area. By the year 2000 the IPUR region, which will then be slightly more extensive in land area than the nine-county territory, is projected to have two million more people than the Office of Area Development sees for the latter region.

Even more interesting is the difference in the consequences of the two approaches for population density. According to the past record, the IPUR metropolitan area, as we have seen, had a rise in population density and then a decline. The decline was particularly noticeable after 1920, and, according to the projections, it is scheduled to continue,

[10] U. S. Department of Commerce, Office of Area Development, *Future Development of the San Francisco Bay Area, 1960–2020,* Washington, D.C.: Government Printing Office, 1959, p. XX.

[11] Robert K. Arnold, *et al., The California Economy, 1947–1980,* Menlo Park, Calif.: Stanford Research Institute, 1960, p. 87.

[12] Warren S. Thompson, *Growth and Changes in California's Population,* Los Angeles: Haynes Foundation, 1955, p. 347. Thompson treated six counties (Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Solano) as one region, made Santa Clara County a separate region, and counted Napa and Sonoma counties as a third region; whereas the other two studies treated all nine counties as one region. Obviously, the nine counties were more close-knit economically in 1960 than they were in 1955, but the diversity of treatment shows that the reader must be on his guard when he speaks of the "Bay Area."

although at a lessening rate of fall. This apparently accords with the public's general impression. The suburbanization movement is felt to be a movement toward low-density housing and low-density shopping areas—a movement that began when the automobile and the motor-bus became popular, when highways were improved and rural utilities and communications were perfected, and which has accelerated as through-

TABLE 8

PROJECTIONS FOR THE IPUR METROPOLITAN AREA AND THE NINE-COUNTY AREA COMPARED

Year	Area (in square miles)		Population (in thousands)		Density	
	IPUR MA	9-county Area[a]	IPUR MA	9-county area[b]	IPUR MA	9-county area
1880	56	6,980	274	422	4,907	60
1900	83	6,980	451	658	5,417	94
1920	165	6,980	881	1,183	5,334	169
1940	349	6,980	1,375	1,734	4,936	249
1960	1,286	6,980	3,217	3,639	2,501	521
Projected						
1980	4,104[c]	6,980	5,700	5,729	1,389	821
2000	7,663[c]	6,980	10,300	8,261	1,134	1,184

[a] The land area of the counties has fluctuated slightly, but the variations are too small and too compensatory to make a noticeable difference in the net area for the nine counties—Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma.

[b] Projections made by U. S. Department of Commerce, Office of Area Development, *Future Development of the San Francisco Bay Area 1960–2020*, Washington, D.C.: U. S. Government Printing Office, 1959, p. 17; actual figures from Warren S. Thompson, *Growth and Changes in California's Population*, Los Angeles: Haynes Foundation, 1955, p. 333, and U. S. Bureau of the Census, *County and City Data Book 1962*, Washington, D.C.: Government Printing Office, 1962, pp. 32, 42.

[c] Projected on basis of fitted logistic curve assuming an upper asymptote of 10,000 square miles (see text).

ways have come into being and as facilities for instantaneous communication by radio, television, telephone, and cinema have become available.[13] The central cities have gained little or have even lost in population, while the suburbs, especially the ever-more-distant fringe areas, have burgeoned in residences, retail establishments, and even industries, all using more land per unit than ever before.

The steady rise in density for the nine-county area is therefore simply a product of having taken a fixed area, rather than the actual and changing urbanized region, as the basis for calculation. As the area embraced by the metropolitan complex has expanded, it has necessarily included an ever greater proportion of the nine counties, with a result-

[13] See Kingsley Davis, "Urbanization—Changing Patterns of Living," in Hoke S. Simpson (Ed.), *The Changing American Population*, New York: Institute of Life Insurance, 1962, ch. 3; and "Urban Demography and Ecology: Research Problems with Special Reference to Metropolitan Affairs in California," *Alpha Kappa Deltan* 28: 9–27, Winter, 1958.

ing increase in average density for the total land in these counties. But this rise in density refers only to the average for all of the nine counties, and they are not a genuine unit in urban terms. What the ordinary person feels to be the urban unit—namely, the expanding metropolis—has shown a declining density, although this lessened density covers a wider area and embraces a great many more thousands of people than the old, higher density did. The nine-county area is not a meaningful unit in any economic or social sense and has no significance when used over time as if it were such a unit.

Projected Territorial Growth

We have seen that present population trends, if they are extrapolated many decades into the future, lead to paradoxical results. If, for example, the Bay Area's population growth rate of 1880 to 1960 were to continue, the inhabitants would number 31.4 million in 2040; 270 million in 2120! Equally paradoxical are the results of extrapolating past land-use trends into the future—and the impossibility of these results actually occurring is brought home by a stubborn fact—the limitation of land. For instance, when the changing territorial extent of the Bay Area metropolitan complex, as we have delimited it, is plotted on a semi-logarithmic scale, it turns out to have, as we were surprised to find, a rising slope (see Chart 2). The historical trend can be described with a Gompertz curve, and extrapolation of this curve yields an area of 128,825 square miles by the end of the century, an area that would represent 82 per cent of all the land in California.

The absurdity of this result becomes apparent when we realize that there are numerous other urban complexes in or near the state—one of them far larger than the Bay Area complex—all of them expanding rapidly both in territory and in population. Long before any one of these complexes could cover 129,000 square miles, it would collide with others. When metropolitan units run into one another, they can no longer be regarded as separate urban entities. To speak of the "Bay Area" as growing to the point where it covers four fifths of California overlooks the fact that it would long since have linked up with Los Angeles, San Diego, Stockton, etc., and would probably be called "Los Angeles." It is therefore patently nonsensical to extrapolate the past growth of a city's territory indefinitely into the future.

Accordingly, in estimating the future territorial growth of the Bay Area complex, we have avoided the assumption of permanent increase. Instead we have fitted to the past growth a so-called logistic curve which has an automatic reducer that eventually causes the values to approach an upper asymptote (limit). As the upper asymptote in our

case, we have assumed that the greatest territorial extent the Bay Area complex will ever reach is 10,000 square miles—about a fourth larger than the nine counties previously mentioned and more than twice the size of Connecticut. On this assumption, the projected area according to the logistic formula is as follows:[14]

	Square miles
1960	1,286 (actual)
1970	2,428
1980	4,104
1990	6,017
2000	7,663

Projected Population Densities

Reference has already been made to the fact that our projections call for a continued decline in population density in the San Francisco Bay metropolitan area. The decline will slow down and finally reverse itself within this century if our projections of territory and population both hold true (see Table 9). This reversal in average density trends would appear to be inevitable. With the supply of inhabitable land limited, continued growth of population both inside and outside the Bay Area urban complex will eventually make it impossible for each inhabitant to have as much living space as he now has. Our projections treat the Bay Area's population growth as if it were a self-contained entity, which of course is not the case. If the area and population of the Sacramento and Stockton urbanized areas should grow as fast as the Bay Area we have delimited, they would contain nearly two million people by the end of the century and would cover more than one thousand square miles. Their territories would have merged with each other and would be colliding with the Bay Area boundaries.

There seems no escaping the fact that continued population growth will, in time, mean greater residential density. Expedients such as filling in the Bay will have little effect, because the area of the Bay is small in relation to the total territory concerned.[15] When the density begins to rise again, it will be different in significance from a similar density at an earlier time. In 1920, when the urbanized area included only 157

[14] The formula:

$$\text{Area} = \frac{k}{1 + e^{a} + bt}$$

where "k" is the upper asymptote (in this case 10,000 square miles), "t" is time (measured in terms of decades from the point of origin), and "a" and "b" are constants. The point of origin was taken as 1940.

[15] The U. S. Department of Commerce, Office of Area Development, *op. cit.*, p. 79, estimated that as of 1957 the area available for reclamation from the Bay was 325 square miles.

TABLE 9

PROJECTED DENSITY OF THE IPUR METROPOLITAN AREA

Year	Projected area (square miles)	Projected populations (in thousands)		Average density (Population per square mile)	
		Average high	Average low	High	Low
Actual					
1960	1,286	3,217	3,217	2,501	2,501
Projected					
1970	2,428	4,600	3,700	1,895	1,524
1980	4,104	6,600	4,700	1,608	1,145
1990	6,017	9,300	5,900	1,546	981
2000	7,663	13,200	7,300	1,723	953

square miles, it was not hard to get out of the city. When the sprawling metropolis of the year 2000 covers 7,663 square miles, the distance from the center to the periphery will be approximately 50 miles. Even after one has traversed the 50 miles, there will be no necessary release from urban congestion, for the traveler may simply find himself in the Sacramento or Stockton urban complex.

Let us reiterate: We do not maintain that the territory and population of the Bay Area will in fact continue to grow as depicted during the rest of the century. Even without overwhelming catastrophies, it is possible to foresee developments that will push the actual figures outside our limits. The level of living has been rising; consequently the demand for land and goods has been growing even faster than the population. No one can say for sure what scarcities will be encountered—whether in water, clean air, living space, meat, fuel, or other resources—that will be increasingly costly to surmount. No one can be sure what will be the demographic and ecological reaction of people to continued growth. The most certain thing about the future is that present trends will not continue indefinitely.

APPENDIX A

Components of the IPUR Metropolitan Area: Population, 1852–1960

(thousands)

	1852	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960
1852:												
San Francisco	34.8	56.8	149.5	234.0	299.0	342.8	416.9	506.7	634.4	634.5	775.4	740.3
1870:												
Alameda	....	....	1.6	5.7	11.2	16.5	23.4	28.8	35.0	36.3	64.4	63.9
Brooklyn	....	....	1.6	annexed to Oakland								
Oakland	....	....	10.5	34.6	48.7	67.0	150.2	216.3	284.0	302.0	385.5	367.5
1890:												
Berkeley	....	....	....	....	5.1	13.2	40.4	56.0	82.1	85.5	113.8	111.3
1900:												
Belvedere	....	....	....	....	....	0.4	0.5	0.6	0.5	0.5	0.8	2.1
Emeryville	....	....	....	....	....	1.0	2.6	2.4	2.3	2.5	2.9	2.7
Hayward	....	....	....	....	....	2.0	2.7	3.5	5.5	6.7	14.3	72.7
San Leandro	....	....	....	....	....	2.3	3.5	5.7	11.5	14.6	27.5	66.0
San Rafael	....	....	....	....	....	3.9	5.9	5.5	8.0	8.6	13.8	20.5
Sausalito	....	....	....	....	....	1.6	2.4	2.8	3.7	3.5	4.8	5.3
1910:												
Burlingame	....	....	....	....	....	....	1.6	4.1	13.3	15.9	19.9	24.1
Larkspur	....	....	....	....	....	....	0.6	0.6	1.2	1.6	2.9	5.7
Mill Valley	....	....	....	....	....	....	2.6	2.6	4.2	4.8	7.3	10.4
Piedmont	....	....	....	....	....	....	1.7	4.3	9.3	9.9	10.1	11.1
Richmond	....	....	....	....	....	....	6.8	16.8	20.1	23.6	99.5	71.9
Ross	....	....	....	....	....	....	0.6	0.7	1.4	1.8	2.2	2.6
San Anselmo	....	....	....	....	....	....	1.5	2.5	4.7	5.8	9.2	11.6
San Mateo	....	....	....	....	....	....	4.4	6.0	13.4	19.4	41.8	69.9
South San Francisco	....	....	....	....	....	....	2.0	4.4	6.2	6.6	19.4	39.4
1920:												
Albany	....	....	....	....	....	....	....	2.5	8.6	11.5	17.6	14.8
Corte Madera	....	....	....	....	....	....	....	0.6	1.0	1.1	1.9	6.0
Daly City	....	....	....	....	....	....	....	3.8	7.8	9.6	15.2	44.8
El Cerrito	....	....	....	....	....	....	....	1.5	3.9	6.1	18.0	25.4
Hillsborough	....	....	....	....	....	....	....	0.9	1.9	2.7	3.5	7.6
San Bruno	....	....	....	....	....	....	....	1.6	3.6	6.5	12.5	29.1
1930:												
Atherton	....	....	....	....	....	....	....	....	1.2	1.9	3.6	7.7
Belmont	....	....	....	....	....	....	....	....	1.0	1.2	5.6	16.0
Colma	....	....	....	....	....	....	....	....	0.4	0.4	0.3	0.5
Menlo Park	....	....	....	....	....	....	....	....	2.3	3.3	13.6	27.0

APPENDIX A—*Continued*

	1852	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960
1930—*Continued*												
Mountain View	....	....	....	....	....	....	....	....	3.3	3.9	6 6	30.9
Palo Alto	....	....	....	....	....	....	....	....	13.7	16.8	25.5	52.3
Redwood City	....	....	....	....	....	....	....	....	9.0	12.5	25.5	46.3
San Carlos	....	....	....	....	....	....	....	....	1.1	3.5	14.4	21.4
San Jose	....	....	....	....	....	....	....	....	57.7	68.5	95.3	204.2
Santa Clara	....	....	....	....	....	....	....	....	6.3	6.6	11.7	58.9
Sunnyvale	....	....	....	....	....	....	....	....	3.1	4.4	9.8	52.9
1940:												
Fairfax	....	....	....	....	....	....	....	....	....	2.2	4 1	5.8
Remainder of Contra Costa Township No. 7	....	....	....	....	....	....	....	....	....	3.4	6.6	[a]
Remainder of Eden Township (Alameda County)	....	....	....	....	....	....	....	....	....	22.4	73 8	[a]
Remainder of San Mateo Township No. 5	....	....	....	....	....	....	....	....	....	2.7	0.6	[a]
1950:												
Benicia	....	....	....	....	....	....	....	....	....	....	7.3	6.1
Centerville	....	....	....	....	....	....	....	....	....	....	1.4	[b]
Concord	....	....	....	....	....	....	....	....	....	....	7.0	36.2
Decoto	....	....	....	....	....	....	....	....	....	....	2.8	[b]
El Monte	....	....	....	....	....	....	....	....	....	....	2.5	4.2
Hercules	....	....	....	....	....	....	....	....	....	....	0.3	0.3
Martinez	....	....	....	....	....	....	....	....	....	....	8.3	9.6
Millbrae	....	....	....	....	....	....	....	....	....	....	9.0	15.9
Newark	....	....	....	....	....	....	....	....	....	....	1.5	9.9
Niles	....	....	....	....	....	....	....	....	....	....	1.5	[b]
Pinole	....	....	....	....	....	....	....	....	....	....	1 1	6 1
Pleasant Hill	....	....	....	....	....	....	....	....	....	....	5 7	24 0
San Pablo	....	....	....	....	....	....	....	....	....	....	11.5	19.7
Saranap	....	....	....	....	....	....	....	....	....	....	2.4	6 5
Vallejo	....	....	....	....	....	....	....	....	....	....	26 0	60 9
Walnut Creek	....	....	....	....	....	....	....	....	....	....	2.4	9 9
Remainder of Sausalito Township (Marin County)	....	....	....	....	....	....	....	....	....	....	13.2	[a]
Remainder of San Mateo Township No. 1	....	....	....	....	....	....	....	....	....	....	16 7	[a]
Remainder of San Mateo Township No. 3	....	....	....	....	....	....	....	....	....	....	37 3	[a]
Remainder of San Rafael Township (Marin County)	....	....	....	....	....	....	....	....	....	....	14 2	[a]
1960:												
Fremont	....	....	....	....	....	....	....	....	....	....	....	43.8
Novato	....	....	....	....	....	....	....	....	....	....	....	17.9

Woodside	....	....	....	....	....	....	....	....	....	....	....	3.6
Alamo-Danville census division[a]	....	....	....	....	....	....	....	....	....	....	....	12.7
Bayshore-Brisbane c.d.	....	....	....	....	....	....	....	....	....	....	....	6.7
Briones c.d.	....	....	....	....	....	....	....	....	....	....	....	0.9
Castro Valley c.d.	....	....	....	....	....	....	....	....	....	....	....	38.2
Crockett c.d.	....	....	....	....	....	....	....	....	....	....	....	3.9
Kensington c.d.	....	....	....	....	....	....	....	....	....	....	....	6.2
Lafayette c.d.	....	....	....	....	....	....	....	....	....	....	....	17.8
Los Altos Hills-Monte Bello c.d.	....	....	....	....	....	....	....	....	....	....	....	6.5
Los Gatos c.d.	....	....	....	....	....	....	....	....	....	....	....	18.4
Lucas-Gallinas Valley c.d.	....	....	....	....	....	....	....	....	....	....	....	14.3
Milpitas c.d.	....	....	....	....	....	....	....	....	....	....	....	7.0
Orinda-Moraga c.d.	....	....	....	....	....	....	....	....	....	....	....	16.7
Pacifica c.d.	....	....	....	....	....	....	....	....	....	....	....	21.7
Rodeo c.d.	....	....	....	....	....	....	....	....	....	....	....	6.7
Saratoga c.d.	....	....	....	....	....	....	....	....	....	....	....	15.3
Remainder of Burlingame c.d.	....	....	....	....	....	....	....	....	....	....	....	1.1
Remainder of Concord c.d.	....	....	....	....	....	....	....	....	....	....	....	8.9
Remainder of Daly City c.d.	....	....	....	....	....	....	....	....	....	....	....	6.2
Remainder of Hayward c.d.	....	....	....	....	....	....	....	....	....	....	....	57.9
Remainder of Martinez c.d.	....	....	....	....	....	....	....	....	....	....	....	11.4
Remainder of Menlo Park c.d.	....	....	....	....	....	....	....	....	....	....	....	21.5
Remainder of Mill Valley c.d.	....	....	....	....	....	....	....	....	....	....	....	7.1
Remainder of Mountain View-Los Altos c.d.	....	....	....	....	....	....	....	....	....	....	....	33.1
Remainder of Palo Alto c.d.	....	....	....	....	....	....	....	....	....	....	....	10.0
Remainder of Pinole-Hercules c.d.	....	....	....	....	....	....	....	....	....	....	....	0.1
Remainder of Redwood City c.d.	....	....	....	....	....	....	....	....	....	....	....	16.6
Remainder of Richmond c.d.	....	....	....	....	....	....	....	....	....	....	....	29.0
Remainder of Ross Valley c.d.	....	....	....	....	....	....	....	....	....	....	....	14.8
Remainder of San Carlos c.d.	....	....	....	....	....	....	....	....	....	....	....	1.6
Remainder of San Jose c.d.	....	....	....	....	....	....	....	....	....	....	....	104.7
Remainder of San Leandro c.d.	....	....	....	....	....	....	....	....	....	....	....	17.1
Remainder of San Mateo c.d.	....	....	....	....	....	....	....	....	....	....	....	3.8
Remainder of San Rafael c.d.	....	....	....	....	....	....	....	....	....	....	....	1.6
Remainder of Santa Clara-Sunnyvale c.d.	....	....	....	....	....	....	....	....	....	....	....	22.7
Remainder of Sausalito c.d.	....	....	....	....	....	....	....	....	....	....	....	4.2
Remainder of South San Francisco c.d.	....	....	....	....	....	....	....	....	....	....	....	0.5
Remainder of Tiburon c.d.	....	....	....	....	....	....	....	....	....	....	....	7.1
Remainder of Walnut Creek c.d.	....	....	....	....	....	....	....	....	....	....	....	17.5
Metropolitan Area Total	34.8	56.8	163.2	274.3	364.0	450.7	670.3	881.2	1,266.7	1,375.3	2,153.3	3,216.7

[a] In 1960 these areas shown as "remainder of . . . census division."
[b] Part of Fremont in 1960.
[c] Hereinafter abbreviated: c.d.

APPENDIX B

Components of the IPUR Metropolitan Area: Estimated Territory, 1852–1960

(square miles)

	1852	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960
1852:												
San Francisco	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	44.6	44.6	47.6
1870:												
Alameda	....	....	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	10.7	8 6
Brooklyn	not available			annexed to Oakland								
Oakland	....	....	7.4	7.4	7.4	12.7	45.7	45.7	53.2	52.8	53.0	53.0
1890:												
Berkeley	....	....	....	....	8.6	8.6	8.6	8.6	8.6	9.4	9.5	9.7
1900:												
Belvedere	....	....	....	....	....	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Emeryville	....	....	....	....	....	1.0	1.0	1.0	1.0	1.0	1.0	2.1
Hayward	....	....	....	....	....	1.9	1.9	1.9	1.9	1.9	4.8	27.6
San Leandro	....	....	....	....	....	2.6	2.6	2.6	2.6	2.6	3.9	14.6
San Rafael	....	....	....	....	....	5.4	5.4	5.4	5.4	5.4	5.4	10.1
Sausalito	....	....	....	....	....	1.5	1.5	1.5	1.5	1.5	1.5	1.7
1910:												
Burlingame	....	....	....	....	....	....	2.2	2.2	2.2	2.2	2 2	5.2
Larkspur	....	....	....	....	....	....	3.0	3.0	3.0	3.0	3 0	2.8
Mill Valley	....	....	....	....	....	....	2.3	2.3	2.3	2.3	2 3	3.2
Piedmont	....	....	....	....	....	....	1.8	1.8	1.8	1.8	1 8	1.6
Richmond	....	....	....	....	....	....	9.7	9.7	9.7	13.2	14.5	28.6
Ross	....	....	....	....	....	....	1.5	1.5	1.5	1.5	1.5	1.5
San Anselmo	....	....	....	....	....	....	2.0	2.0	2.0	2.0	2.0	2.7
San Mateo	....	....	....	....	....	....	7.1	7.1	7.1	7.1	8.7	9.8
South San Francisco	....	....	....	....	....	....	5.0	5.0	5.0	5.0	10.0	6.8
1920:												
Albany	....	....	....	....	....	....	....	1.6	1.6	1.6	1.6	5.0
Corte Madera	....	....	....	....	....	....	....	0.7	0.7	0.7	0.7	3.0
Daly City	....	....	....	....	....	....	....	1.2	1.2	1.2	3.0	4.2
El Cerrito	....	....	....	....	....	....	....	3.3	3.3	3.3	3.3	4.0
Hillsborough	....	....	....	....	....	....	....	5.8	5.8	5.8	5.8	6.4
San Bruno	....	....	....	....	....	....	....	1.8	1.8	1.8	3.1	5.6
1930:												
Atherton	....	....	....	....	....	....	....	....	4.5	4.5	4.5	4.8
Belmont	....	....	....	....	....	....	....	....	2.6	2.6	3.9	4.3
Colma	....	....	....	....	....	....	....	....	2.0	2.0	2.0	2.0
Menlo Park	....	....	....	....	....	....	....	....	1.2	1.2	3.6	8.4

Mountain View	....	....	....	....	....	....	....	....	0.7	0.7	0.7	8.3
Palo Alto	....	....	....	....	....	....	....	....	4.8	4.8	6 7	21.7
Redwood City	....	....	....	....	....	....	....	....	4.5	4.5	7.4	19.2
San Carlos	....	....	....	....	....	....	....	....	2.6	2.6	2.6	4.6
San Jose	....	....	....	....	....	....	....	....	14.8	14.8	14.8	54.5
Santa Clara	....	....	....	....	....	....	....	....	3.4	3.4	3.4	11.3
Sunnyvale	....	....	....	....	....	....	....	....	1.5	1.5	1.5	16.5
1940:												
Fairfax	....	....	....	....	....	....	....	....	....	5.0	5.0	2.1
Remainder of Contra Costa Township No. 7	....	....	....	....	....	....	....	....	....	4.7	4.7	[a]
Remainder of Eden Township (Alameda County)	....	....	....	....	....	....	....	....	....	68.3[b]	65.7[b]	[a]
Remainder of San Mateo Township No. 5	....	....	....	....	....	....	....	....	....	3.9	3.9	[a]
1950:												
Benicia	....	....	....	....	....	....	....	....	....		3.1	3.7
Centerville	....	....	....	....	....	....	....	....	....	....	2.0	[c]
Concord	....	....	....	....	....	....	....	....	....	....	3.2	8.0
Decoto	....	....	....	....	....	....	....	....	....	....	2.0	[c]
El Monte	....	....	....	....	....	....	....	....	....	....	1.0	1.0
Hercules	....	....	....	....	....	....	....	....	....	....	5.0	5.0
Martinez	....	....	....	....	....	....	....	....	....	....	3.3	3.3
Millbrae	....	....	....	....	....	....	....	....	....	....	3.0	3 1
Newark	....	....	....	....	....	....	....	....	....	....	7.9	7.9
Niles	....	....	....	....	....	....	....	....	....	....	2.0	[c]
Pinole	....	....	....	....	....	....	....	....	....	....	3.6	3.6
Pleasant Hill	....	....	....	....	....	....	....	....	....	....	5.7	5.7
San Pablo	....	....	....	....	....	....	....	....	....	....	2.5	2.9
Saranap	....	....	....	....	....	....	....	....	....	....	1.7	1.7
Vallejo	....	....	....	....	....	....	....	....	....	....	5.9	13.3
Walnut Creek	....	....	....	....	....	....	....	....	....	....	0.6	4.9
Remainder of Sausalito Township (Marin County)	....	....	....	....	....	....	....	....	....	....	72.2	[a]
Remainder of San Mateo Township No. 1	....	....	....	....	....	....	....	....	....	....	50.0	[a]
Remainder of San Mateo Township No. 3	....	....	....	....	....	....	....	....	....	....	120.0	[a]
Remainder of San Rafael Township (Marin County)	....	....	....	....	....	....	....	....	....	....	60.7	[a]
1960:												
Fremont	....	....	....	....	....	....	....	....	....	....	....	87.0
Novato	....	....	....	....	....	....	....	....	....	....	....	11.6
Woodside	....	....	....	....	....	....	....	....	....	....	....	12.0
Alamo-Danville census division[d]	....	....	....	....	....	....	....	....	....	....	....	69.0
Bayshore-Brisbane c.d.	....	....	....	....	....	....	....	....	....	....	....	8.0
Briones c.d.	....	....	....	....	....	....	....	....	....	....	....	46.0
Castro Valley c.d.	....	....	....	....	....	....	....	....	....	....	....	9.0
Crockett c.d.	....	....	....	....	....	....	....	....	....	....	....	5.0

APPENDIX B—*Continued*

	1852	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960
1960—*Continued*												
Kensington c.d.	....	....	....	....	....	....	....	....	....	....	....	1.0
Lafayette c.d.	....	....	....	....	....	....	....	....	....	....	....	23.0
Los Altos Hills-Monte Bello c.d.	....	....	....	....	....	....	....	....	....	....	....	37.0
Los Gatos c.d.	....	....	....	....	....	....	....	....	....	....	....	19.0
Lucas-Gallinas Valley c.d.	....	....	....	....	....	....	....	....	....	....	....	17.0
Milpitas	....	....	....	....	....	....	....	....	....	....	....	21.0
Orinda-Moraga c.d.	....	....	....	....	....	....	....	....	....	....	....	44.0
Pacifica c.d.	....	....	....	....	....	....	....	....	....	....	....	16.0
Rodeo c.d.	....	....	....	....	....	....	....	....	....	....	....	2.2
Saratoga c.d.	....	....	....	....	....	....	....	....	....	....	....	16.0
Remainder of Burlingame c.d.	....	....	....	....	....	....	....	....	....	....	....	0.3
Remainder of Concord c.d.	....	....	....	....	....	....	....	....	....	....	....	10.0
Remainder of Daly City c.d.	....	....	....	....	....	....	....	....	....	....	....	1.8
Remainder of Hayward c.d.	....	....	....	....	....	....	....	....	....	....	....	25.4
Remainder of Martinez c.d.	....	....	....	....	....	....	....	....	....	....	....	20.7
Remainder of Menlo Park c.d.	....	....	....	....	....	....	....	....	....	....	....	8.6
Remainder of Mill Valley c.d.	....	....	....	....	....	....	....	....	....	....	....	20.8
Remainder of Mountain View-Los Altos c.d.	....	....	....	....	....	....	....	....	....	....	....	12.7
Remainder of Palo Alto c.d.	....	....	....	....	....	....	....	....	....	....	....	8.3
Remainder of Pinole-Hercules c.d.	....	....	....	....	....	....	....	....	....	....	....	1.4
Remainder of Redwood City c.d.	....	....	....	....	....	....	....	....	....	....	....	4.8
Remainder of Richmond c.d.	....	....	....	....	....	....	....	....	....	....	....	8.3
Remainder of Ross Valley c.d.	....	....	....	....	....	....	....	....	....	....	....	27.9
Remainder of San Carlos c.d.	....	....	....	....	....	....	....	....	....	....	....	4.9
Remainder of San Jose c.d.	....	....	....	....	....	....	....	....	....	....	....	130.5
Remainder of San Leandro c.d.	....	....	....	....	....	....	....	....	....	....	....	2.4
Remainder of San Mateo c.d.	....	....	....	....	....	....	....	....	....	....	....	12.2
Remainder of San Rafael c.d.	....	....	....	....	....	....	....	....	....	....	....	1.9
Remainder of Santa Clara-Sunnyvale c.d.	....	....	....	....	....	....	....	....	....	....	....	18.2
Remainder of Sausalito c.d.	....	....	....	....	....	....	....	....	....	....	....	9.3
Remainder of South San Francisco c.d.	....	....	....	....	....	....	....	....	....	....	....	3.2
Remainder of Tiburon c.d.	....	....	....	....	....	....	....	....	....	....	....	7.0
Remainder of Walnut Creek c.d.	....	....	....	....	....	....	....	....	....	....	....	13.4
Metropolitan Area Total	42.0	42.0	55.9	55.9	64.5	83.2	150.8	165.2	215.3	303.7	684.7	1,286.0

[a] In 1960 these areas shown as "remainder of . . . census division."
[b] Sixty percent of the remaining territory of Eden Township, excluding approximately that part which in 1960 is the Crow Canyon-Palomares census division (not included in 1960).
[c] Part of Fremont in 1960.
[d] Hereinafter abbreviated: c.d.

II

T. J. KENT, JR.

CITY AND METROPOLITAN REGIONAL PLANNING . . .

City and Regional Planning for the Metropolitan San Francisco Bay Area

INSTITUTE OF GOVERNMENTAL STUDIES
University of California • Berkeley, California
DWIGHT WALDO, Director

City and Regional Planning for the Metropolitan San Francisco Bay Area

BY
T. J. KENT, Jr.
Department of City and Regional Planning

1963

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Introduction

By 1960 there was substantial agreement for the first time throughout the San Francisco Bay Area that metropolitanwide physical development problems existed and that these problems inevitably would become more and more serious. It was also generally acknowledged for the first time that governmental action above the level of the area's city and county governments would be necessary during the next twenty years if these problems were going to be dealt with effectively.

With the exception of rapid transit and air pollution, however, there was no agreement on what to do about the specific problems. Nor was there agreement on how to prepare a metropolitan regional plan—a plan that would face the problems, augment existing city and county general plans, and propose a comprehensive, workable solution.

If a Bay Area regional plan for physical development is prepared during the next ten years, it may be possible to retain and enhance the highly productive, still-growing concentrations in the central districts of San Francisco, Oakland, and San Jose; to save the inner Bay shoreline and outlying agricultural valleys and grazing lands from wasteful suburban and industrial sprawl; and to renew and improve the remarkably well articulated system of cities that man has built around the shores of the Bay and in its tributary valleys during the past 100 years.

If a regional plan is not prepared, I believe the people of the Bay Area will inevitably destroy their heritage of natural beauty—which they do not want to do. They will also break up the economic unity of the existing man-made metropolis which, despite certain shortcomings, still provides great advantages to the economic and social enterprises and workers of the area.

Without a regional plan, the so-called "natural" forces of economic development will overwhelm the best efforts of local governments to control them. This is what has happened during the seventeen-year postwar period in the great circle around the Bay. Speculative land development forces now operate on a metropolitanwide basis. They are commanded by men of great enterprise and ability. These men—the builders and doers of today—will wipe out the vineyards of the upper Napa Valley and fill it with suburban tracts; they will overrun the Livermore Valley; they will mop up Stinson Beach, Bolinas, and the Olema Valley. They will spread to the northeast, beyond Vallejo and Fairfield toward Sacramento; to the south, below San Jose to Hollister; and to the west, beyond Santa Rosa to Sebastopol and the Pacific Ocean.

Industry will follow the suburban flood. Freeways will precede the initial wave of surging growth, and more freeways will follow. Predictably inadequate bridges for trucks and automobiles will be constructed crisscrossing the Bay. Transit—despite its victory in 1962—will be killed. Bay tidelands will be filled. The central districts of San Francisco, Oakland, and San Jose will become inaccessible, and will decay.

All this does not have to happen; but there are informed observers who say that it will.

In the following pages I present a group of ideas which, if implemented, would provide the metropolitan community of the San Francisco Bay Area with an effective means of governing the enlargement and adjustment of our metropolitan structure to accommodate the flood of newcomers anticipated during the next several decades. The ideas put forward for consideration are evolutionary and conservative, both in terms of American local self-government and in terms of the physical organization of a great city—which is what the metropolitan Bay Area really is.

I will attempt to state my biases as the exposition proceeds. It will, I trust, be clear to the reader whose basic notions of democratic government and metropolitan physical form are fundamentally different from mine, that opposition to my proposals should be debated, first, in terms of these underlying ideas.

At the outset I also wish to state my belief that there is a chance for the Bay Area to win its struggle to create an effective metropolitan "federal union" of its 94 city and county "sovereign colonial governments" before we lose our priceless environmental heritage. I am an optimist as well as a realist. I am willing to try, and to keep on trying.

Long-Range Local and Metropolitan Objectives

As a citizen and as a city planner concerned about the future of the metropolitan Bay Area, I believe it is necessary, at the beginning of a discussion such as this, to attempt to state one's views concerning the governmental context within which a regional plan-making agency can be effective. The fundamental beliefs one has concerning the future of local government in relation to the roles to be played by state and federal governments in local affairs will inevitably have a direct bearing on ideas as to what should be done to meet the areawide problems of physical development at the metropolitan level.

A Two-Level System of Government

I foresee—and I advocate--the gradual development of a two-level system of local and metropolitan government for the Bay Area. Twenty or thirty years from now, the local municipal governments will have become more numerous as a result of the formation of new cities in the outlying areas. These governments will also have become more powerful. Like the Swiss, the people of the Bay Area will have decided in favor of all-purpose, home rule cities. Also like the Swiss, they will have created a unified, limited-function federation of local governments, largely controlled by the cities, to handle areawide problems.

Many responsible, thoughtful leaders of Bay Area business, labor, and civic affairs, many members of the editorial staffs of our metropolitan newspapers, most of the area's active liberal reformers, many state and federal political leaders, and a very high proportion of the influential administrative officials of these governments, as well as professionals from all fields at all levels, take it for granted that city and county governments are outmoded and unworkable. They also believe that local governments, realistically, will always be led by relatively ignorant, narrow-minded men and women—democracy's "third string" team. The editorials and cartoons of the *San Francisco Chronicle* conveyed these beliefs with conviction and with great gusto during the 1959 session of the California Legislature when the unsuccessful proposal to create a "Golden Gate Authority," which the *Chronicle* supported, was opposed by many Bay Area city and county governments.

Citizens such as these, most of whom have had little or no experience in the discipline of local self-government, are willing—indeed, they seem eager—to throw away a democratic system that is the result of

centuries of struggle. New York, with one municipal government for eight million people, is pointed to as a model.

I believe that the ideals of our democracy point in exactly the opposite direction. The historical point of view and the political philosophy that seem most reasonable to me were superbly expressed by James R. Ellis, one of the outstanding civic leaders of Seattle, in a speech before the 1959 national meeting of the American Institute of Planners. In discussing local and metropolitan government proposals for the Seattle area, Mr. Ellis said:

> If a large number of people are to find a good life within a limited area they must admit the need to order their lives with regard for the rights of others. To achieve this order we have traditionally divided land into territories and vested in men the power to make and enforce rules within these territories. These rules began with the efforts of men in the smallest of groups who sought to resolve conflicts between the individual's desire for freedom and his need for restraint. From the application of these rules our systems of law and government slowly evolved. Inherent in their development from the beginning has been a need to control the power thus vested. The larger the grant of power the greater the need for control. Much of the thrilling history of restraint of government power has been furnished by towns and local communities. This source of restraint was local because at that level the public conscience made itself felt most directly. Throughout the history of government runs a continuing struggle to find middle ground between tyranny and anarchy. This search for enough, but not too much, restraint is the very heart of the problem of regional organization as it has been for government at all levels.
>
> In searching for solutions to problems of regional organization, the depth of our experience in local government cautions us to respect precedent, but also reminds us that each precedent had its agonizing birth in change from a still more distant precedent. There is no treason in the determination to examine traditional divisions of land and rules of government in an effort to make them do a better job for us, especially if the purpose is to preserve fundamental gains of history. If it be true today, that local government is failing to meet its responsibilities to its people, that this failure is leading to a growing desire for state and national governments to do the job which local government should be doing, and if assumption of local powers by state and national governments is growing—then we must examine local government critically and act strongly and promptly to stop its disintegration before we lose it.

To me a "local" government is one that has been kept small enough—in its number of citizens, its geographic size, and its social institutions—for the system of self-governing to be readily understood and participated in by every citizen who desires to do so. Many people do not and may never wish to participate directly. But if they personally know people who are active, they can decide for themselves on the basis of this kind of direct knowledge whether or not to give their consent to the laws and taxes imposed on them by their friends. If the "local" government becomes remote and incomprehensible, there will be up-

heavals that will damage the community. Public needs of vital importance to the economic and social life of the community will not be understood. Consent will be withheld. In our society the only possible answer is to take steps designed to facilitate greater participation in order to gain the necessary understanding and consent. We should *not* assign the task of determining local policies and providing essential local public services to higher, more distant, more remote levels of government.

Although there are exceptions to every rule, I believe that once a local government exceeds a population of 200,000, or a geographic area of 25 square miles, it can be expected to become remote to many of its citizens sooner or later. I believe that the force of our ideal of self-reliance, combined with the enforcing device of the secret ballot, will compel recognition of this rule. Where the rule has been ignored during the past 75 years, and local municipal governments have been eliminated, or were never permitted to exist—as in New York, Los Angeles, and Chicago—I believe they will eventually be reestablished or created.

The philosophy of local self-government expressed here does not ignore the needs of the larger community—in this case, the metropolitan community. Once this home rule philosophy has been accepted and established, however, as it has been in California since 1879, it eliminates the possibility of central control of local affairs by the state government. That is what caused the home rule revolt of 1879. And home rule eliminates, for all practical purposes, any possibility of a single, consolidated, very large, all-purpose metropolitan government.

In California the system of municipal home rule has, whether one likes it or not, placed in the hands of the leaders of our local governments the political power to make progress or not to make progress on the metropolitan problem. Hence, for both idealistic and realistic reasons, I believe that municipal governments not only should play, but inevitably will be required to play, a role of primary importance in guiding the future development of the metropolitan Bay Area, and in shaping and limiting the powers of the metropolitan government that will have to be created.

Five Metropolitan Functions

As a consequence of these ideas concerning the future role of local government in the Bay Area, I foresee the creation—with the consent of city and county leaders, however reluctantly given—of a unified, limited-function metropolitan Bay Area government. Areawide problems of physical development will compel local governments to assist in the formation of such a government, hopefully in the not too distant fu-

ture. In order to carry out its responsibility to protect and promote the prosperity and welfare of the metropolitan community of the entire Bay Area, this new government will have been assigned, twenty or thirty years from now, at least the following five specific functions concerned with physical development:

1. Regional rapid transit.—The need for this public facility, acknowledged in the early 1950's, will have led to the creation of the finest system of metropolitan transportation ever known. It will have made the Bay Area the most productive, livable, and culturally thriving metropolis in the world. The rapid transit district created in the 1950's will have become one of the five departments of the metropolitan government.

2. Regional air pollution control.—Responsibility for the alleviation of this stubborn areawide public health and amenity problem, which was recognized by the formation of a regional air pollution control district in 1955, will have been reassigned to the unified metropolitan government. New powers of enforcement will have been authorized, and cooperative enforcement procedures will have been worked out with the larger cities.

3. Regional parks and open space.—To augment the system of regional parks and open spaces that still existed as late as 1963—composed of the great open "bluebelt" of the Bay, as well as the traditional greenbelt of surrounding agricultural hills and valleys—a new Bay Area agency will have been created. It will have established cooperative arrangements with all existing large-scale park programs administered by city, county, district, state, and federal agencies, and, where necessary, will have acquired its own great parks. It will also have been assigned the task of governing the use of the Bay and its shoreline for regional recreation purposes, and it will have acquired and arranged to lease entire valleys to guarantee permanent use of exceptional land resources for agricultural and other open space purposes.

4. Bridges and freeways.—Most of the existing Bay bridges and all of the state freeways will have been taken over by the areawide government. No new bridges will have been built and very few new freeways will have been constructed prior to the successful reestablishment of the Bay Area regional and local public transportation system. Throughout the area the regional rapid transit stations will have been augmented by excellent local transit service, including ferryboat lines to waterfront communities not served by the transbay tube. Older and younger citizens, who cannot drive automobiles and whose needs were forgotten during the 1950's and 1960's, will once again be moving about the region freely. They will have created new markets for all sorts of new

enterprises, and will again be making their important contributions to the vitality of metropolitan life.

The State Division of Highways, which was initially created to build a system of highways connecting the cities and regions of the state, will have shifted its program back to this central task. As in the past, the provision of primary thoroughfares within built-up urban areas, i.e., all major city streets and metropolitan freeways, will again be the clear responsibility of urban governments. The Bay Area freeway and bridge system, under the control of the areawide metropolitan government, will of course be fully integrated with the regional transit system.

* * *

These four metropolitan physical development activities will be directly controlled by a single Bay Area legislative body. For several decades, a majority of the members of this governing body will be city and county legislators appointed by their colleagues in a manner similar to the procedures worked out during the 1950's by the successful regional rapid transit and air pollution control districts. The remaining members of the metropolitan legislative body will be directly elected, probably from assembly districts.

The total membership of the governing body will be large. The legislators will choose their own executive committee and study committees. The government will have substantial financial resources. It will have a metropolitanwide tax base, including an income tax, and will accept state and federal grants, but only without the unworkable and unsuitable conditions typically imposed by these governments, with the best of intentions, on the smaller and less influential municipal and county governments.

* * *

5. Bay Area outline regional plan.—The metropolitan governing body will understand the obvious technical need to resolve physical conflicts between the separate plans for regional transit, parks and open spaces, bridges, shoreline development, and freeways. They will be determined to enhance, not destroy, the specialized socio-economic functions and unique environmental advantages of the individual communities of the Bay Area. Members of the metropolitan governing body will have had direct experience in making and using city and county general plans. They will know why a comprehensive, long-range, physical development plan is necessary, how to control it, and how to use it.

As a consequence of these anticipated realities, the areawide government will have a fifth function: the preparation and maintenance of an

outline regional plan for the metropolitan area. This complex, creative, dangerous, and unavoidable task of metropolitan government will attract the attention of leaders throughout the Bay Area. It will be the subject of great controversies and great debates. Support for the major proposals of the plan, or for responsible or irresponsible alternatives to them, will be the basis upon which men and women will be elected and appointed to the metropolitan governing body. The political life of the Bay Area metropolitan community will be transformed after the first Bay Area regional development plan is published. The period of laissez-faire metropolitan sprawl will have been ended. Government—with all its drawbacks—will have replaced metropolitan anarchy.

Limiting the Metropolitan Government

If an effective method of controlling and limiting the specific functions of any metropolitan government proposed for the Bay Area is *not* in existence at the time efforts are made to "do something" about the obvious need for such a government, the political strength of the area's home rule local governments will defeat the formation of a metropolitan government in any form. If an acceptable method of limitation is established now, and tested for several years, Bay Area local government leaders will, I believe, permit a metropolitan government to come into being.

The newly-formed voluntary Association of Bay Area Governments is ideal for the purpose I have outlined above. The association can become the kind of jealous watch-dog agency that is needed. If it is to perform this function, however, it will have to clarify its present constitution. Without plain language defining and limiting its objectives, it probably will continue to attempt to perform impossible tasks, will fail to retain the confidence of its constituent members, and will lose their financial support. It is a voluntary association, consequently it can never perform the painful acts of a government. But it is needed for the following vital purposes:

1. *To strengthen* the city and county governments of the Bay Area, so that everything that can possibly be done locally, will be done locally and will be done well.

2. *To explore and foster* voluntary cooperative solutions for all areawide problems that can be dealt with effectively in this way. The Bay Area already has a remarkable record of accomplishment in this field. We do not need an areawide police system. We do not need an areawide fire protection system. We do not need an areawide water supply system. We do not need an areawide drainage and sewage disposal system. Until we experiment more, we do not know how many additional needs that may *appear* to be nonlocal can actually be provided for by voluntary cooperation or by sub-regional or countywide agencies. I believe that the great majority of what seem to be areawide governmental problems in the metropolitan Bay region can be successfully provided for by cooperative arrangements.

3. *To support* the creation of a unified, limited-function government for the metropolitan Bay Area, such as I have outlined, to deal effectively with those relatively few major public needs that definitely cannot be provided for by voluntary, cooperative action. In addition to the five physical development functions specified in this paper, there un-

doubtedly will be a number of other areawide governmental physical and non-physical needs that eventually will have to be assigned to the metropolitan government. These needs are not generally agreed upon today. There is some indication that seaport and airport facilities and operations may have to be dealt with on an areawide basis. There are also indications that social problems—such as those caused by racial prejudice, large-scale urban renewal programs, and extremely uneven support for education and welfare programs—may result in local determination to act at the metropolitan level, instead of continuing the present trend toward ever-greater reliance in these matters on the state and federal governments.

4. *To oppose,* openly and forcefully, all attempts to transform the limited-function Bay Area government into an all-purpose government. It must be recognized that many citizens, especially professionals and the leaders of the business community, will want this transformation to take place.

* * *

I have presented three main groups of ideas in the preceding pages. They concern: (1) the strength and value of local self-government, (2) the pressing need for a unified, limited-function metropolitan government, and (3) the watchdog role of the Association of Bay Area Governments. These concepts deal, I believe, with three of the basic issues that will have to be openly debated, sooner or later. A definite position on each of these issues will inevitably have to be taken by the authors of every new proposal concerned with the "metropolitan problem" of the Bay Area. Alternative proposals will be more clearly understood, and constructive action can be expected sooner, if the underlying assumptions and convictions held by their authors are plainly set forth for all to see.

Realistically, in the California context, I believe efforts by state and federal governments to intervene in the metropolitan affairs of the Bay Area will be rejected. Indeed, if such efforts continue to be pressed, they will probably cause the present stalemate to be prolonged to the detriment of all concerned. Because of this judgment, and because of positive views concerning the great inherent value and demonstrated comparative effectiveness of home rule governments in the field of physical development, the specific proposal that follows was developed. It is based on the assumption that political leadership within the Bay Area capable of dealing with metropolitan issues will emerge sooner or later. It is also based on the assumption that these local leaders will persuade the metropolitan community to acknowledge the critical nature of its areawide physical development problems, and to accept the need for an effective regional plan-making agency.

Proposed Bay Area Regional Planning District

During the latter part of the 1960's, a substantial proportion of the state Legislature will be composed of men and women who will have had local government experience. Many of these legislators will have served first as members of their city or county planning commissions. Hence I assume that the need for a metropolitan regional plan will become widely appreciated in the relatively near future. Political forces are already requiring every city and county government to prepare and use a general plan. These forces became active in the Bay Area during the postwar decade. They will become dominant during the 1960's. Once the legislators of our city and county governments have learned the necessity and value of city and county general plans, they will recognize the necessity and value of an outline regional plan for the Bay Area.

A regional plan for the Bay Area will focus attention on the specific areawide problems and needs which the local legislators will want to have solved. And the plan will also—if they control it—guarantee the maximum degree of freedom for each constituent community to guide its own physical growth and development in a manner that will enhance its specialized socio-economic role, unique character and geographic setting within the Bay Area.

When the city and county legislators of the Bay Area want a regional plan, they will also recognize, I believe, that such a plan must be prepared by a government. No non-governmental association or voluntary group effort, however well intentioned, can prepare and maintain a *useful* plan. A useful plan is one that will be accepted by the courts as a legitimate public expression of the long-range aspirations and policies of the community, and that can, therefore, be used to explain and justify the need for public actions affecting private property, and for raising and spending public funds for capital improvements. No city council or county board of supervisors would expect to receive a reasonable long-range general development plan that would be useful to them for their own jurisdictions, as a result of the voluntary efforts of the neighborhood improvement associations, chambers of commerce, and other special interest and local interest groups within their territories. City and county legislators understand this. They will, I believe, recognize that the situation is comparable at the level of the metropolitan Bay Area.

If a useful regional plan is to be prepared and maintained, the gov-

erning board that will make the controversial policy decisions shaping the plan must have a competent professional staff. Without a permanent staff, and without authority to finance and maintain this staff, the effort will fail. Here again, local legislators will, I believe, acknowledge these essential requirements once they have convinced themselves that a plan is needed.

The first definite proposal designed specifically to meet the regional planning needs of the Bay Area was made in 1956.[1] Earlier unsuccessful efforts, dating back more than fifty years, were initially patterned on the experience of Chicago and New York, and later were based on the belief that Bay Area needs could be met reasonably within the context of statewide enabling legislation. Proposals that have been made during the past six years have been based almost entirely on the 1956 proposal. Although this proposal is not under active consideration at the present time, it has established the context for current debates on the subject.

The 1956 proposal was designed (1) to meet the technical regional planning needs of the Bay Area; (2) to strengthen the home rule tradition of local government in this particular metropolitan region; and (3) to fit into a unified, limited-function metropolitan government for the Bay Area when such a government is established.

Duties of the Regional Planning District

The four duties of the governing board of the proposed Bay Area regional planning agency may be summarized as follows:

1. **Regional plan.**—The board would prepare, adopt, and maintain an outline regional plan for the physical development of the Bay Area based upon (a) the general plans of the city and county governments of the area, and (b) studies of regionwide needs. The regional plan would provide a framework intended to serve as a guide for local plans and physical development activities of regionwide significance, and for the programs of existing metropolitan single-purpose agencies and the Bay Area agencies of state and federal governments. *The plan would be advisory only,* because there is no legislative body for the metropolitan Bay Area.

2. **Regional studies.**—The board would make regional population, economic, traffic, and other studies to further regional planning, and to assist and strengthen the city and county planning programs of local governments. The board would not be permitted to engage in the usual type of consulting work for local governments now done by private

[1] Bay Area Planning Commissioners' Study Committee, *A Regional Planning Agency for the San Francisco Bay Area* (1956). This is a report and statutory proposal prepared for the city and county planning commissioners of the Bay Area.

consultants and, in some cases, by county planning agencies. This limitation would encourage the board to concentrate on its own plan-making job by not permitting it to divert its efforts into what would be, in metropolitan terms, piecemeal planning activities.

3. **Publication and education.**—The board would be directed to publish, transmit, and explain the regional plan. It would be required to publish a report on the status of the regional plan every year. Since the effectiveness of the plan would be very largely dependent upon voluntary acceptance of the main proposals by a large number of governments and private individuals and firms throughout the Bay Area, this task is of particular importance to a physical planning agency at this level. Consequently it has been defined as one of the four major duties of the board.

4. **Regional cooperation.**—The board would encourage and promote understanding of the need for regional cooperation, and be directed to join with city, county, regional, state, and federal agencies, and with private groups, in the development of procedures for dealing with regional problems of concern to all.

Organization and Financing

The governmental organization and financing provisions of the proposed legislation may be summarized as follows:

1. **Governing board.**—The policy-making governing board of the district would be composed of 33 members. The board would meet regularly at least once every month. Twenty-five of the members would be city councilmen and county supervisors selected by their own groups in accordance with procedures already established in the Bay Area. Eight members would be citizens-at-large, appointed by the 25 city and county legislators.

2. **Staff and financing.**—The proposed legislation calls for the establishment of a regional planning district that would be able to raise its own funds for necessary professional staff services, similar to the provisions of the existing Bay Area Air Pollution Control District and the San Francisco Bay Area Rapid Transit District.

3. **Official representatives and technical committees.**—Each city and county planning commission, state and federal agency, special district, and private and civic group interested in regional development activities would be invited to designate an official representative who would be kept fully informed of all board activities, and who would act as the official spokesman for his group. The board would also appoint special technical advisory committees as needed.

* * *

The duties and organization of the proposed Bay Area Regional Planning District that have been summarized here are conventional and limited. To some critics they appear to be timid, narrowly conceived, and unrealistic. The proposal is, however, the result of a conscious effort to learn from past failures. It attempts to provide for the particular needs of metropolitan regional planning in the Bay Area in such a way that future metropolitanwide needs will be recognized, and that locally sponsored solutions designed to provide for these additional needs will be aided—not forestalled—by the establishment of the regional planning district.

The proposal is based on an open acceptance of the limitations inherent in the home rule approach to metropolitan regional planning. It calls for the formulation of the regional plan on the basis of city and county general plans. It also calls for careful attention to those over-all needs of the region that are not provided for by local plans. Thus such regionwide needs can be studied, understood, and accommodated in the regional plan. The plan-making procedure required by the proposal reflects a conscious realization by the authors that such a complex job will take time if done as it should be, from the ground up. The essential local and regional adjustments will necessitate cooperation and political leadership of a very high order.

If this method of metropolitan regional planning fails—as some respected critics predict—the failures will provide us with the experience necessary to demonstrate the need for the unified, limited-function Bay Area government described in the preceding sections of this essay. The experience will also help us define and limit the additional responsibilities that will have to be assigned to the metropolitan government. But the record by then will include, I believe, far more successes than failures. It will show how many things can be accomplished cooperatively, and how limited are the needs for additional regional agencies with authority to act, such as the existing Bay Area rapid transit and air pollution control agencies.

The predictable, destructive reaction against remote government of local affairs is so harmful, and the existing political power and inherent values of local self-government are so great, that the best hope for constructive action to provide for metropolitan needs is to proceed slowly. Only those areawide needs that are absolutely essential and are not being provided for at all should be assigned to a metropolitan agency. Everything should be done to strengthen the general authority of local government, and everything should be done to limit and confine the functions assigned to the essential areawide metropolitan agencies.

Significant Features of the Proposal

In terms of Bay Area experience—and perhaps also in more general terms—the regional planning district concept represents an effort to improve upon earlier proposals in the manner in which it deals with five of the general problems confronting efforts such as this in metropolitan communities throughout the world.

Composition of the governing board.—Because of the large and increasing number of city and county governments in the Bay Area, and their wide diversity in terms of population size and financial resources, the problem of devising a representative board that will be both acceptable and workable is especially difficult. Many possibilities have been explored. The current proposal is based on the following principles:

1. City and county legislative bodies should be directly represented. They should select their own representatives, and these representatives should constitute a clear majority of the board.

2. An effective method should be worked out to enable the more populous areas and governments of the region to have appropriate additional representation on the board.

3. Some way should be found to enable the board to include in its membership outstanding citizens of the Bay Area who can be expected to make significant contributions, but who are not themselves elected members of city or county legislative bodies.

4. The basic relationships of the regional planning board to city and county governments should be similar to those already established by the Bay Area Air Pollution Control District legislation, in order to focus responsibility on local governments and promote cooperation among metropolitan agencies.

If the combined home rule-federation approach to metropolitan governmental problems is as widely understood in the Bay Area as many local observers believe it is, then sooner or later I believe the present proposal, or some variation of it, will be utilized to solve the difficult question of how to form an acceptable, representative governing board for regional planning purposes.

Financial support.—The district form of single-purpose government, embodied in the 1955 legislation which created the Bay Area Air Pollution Control District, is employed in the regional planning proposal. At the present time there is no realistic alternative capable of assuring continuity and effective financial support for the substantial program that is needed. Arguments against state legislative imposition of a new

special district—with taxing powers—on the home rule city and county governments of the Bay Area were evaluated in relation to: (1) the strong influence of local governments in the Legislature, and their consequent ability to defeat the legislation if they are determined to do so; (2) their direct control of the regional planning board, which would set the tax rate and control the regional plan; and (3) the stimulus that the proposal would give to the idea of integrating the regional planning agency with other existing and proposed single-purpose districts. This concept was developed with the intention of creating a pattern that would facilitate and encourage the establishment of a unified, limited-function government for the metropolitan Bay Area.

Definition of the regional plan.—The metropolitan regional plan is conceived of as a long-range, comprehensive, general plan. Like the general plan for the physical development of any city or urban county, it would be used to guide physical development when such guidance is needed—in the judgment of local legislative bodies and the governing boards of regional agencies—to protect and promote the general welfare of the Bay Area and its communities. Like local plans, again, the regional plan would of course have to be regularly revised to deal with new growth, new technology, and new social values. The provisions of the proposed bill defining the essential physical elements of the plan, the material to be included in the official plan document, and the procedures for assuring regular review, are more specific and more carefully limited than the provisions of earlier proposals. They are an expression of more than thirty years of local, sustained, successful city and county planning experience, and represent an important consensus among the leaders of the city planning profession in the Bay Area.

Relationship to local control of physical development.—The proposal is based on the assumption that for the foreseeable future local governments should—and will—continue to govern the over-all physical development of their communities as they do today, and as they have for almost 80 years in California. The regional rapid transit and air pollution control agencies would, it is assumed, be significantly influenced by those segments of the regional plan directly affecting their programs. This would also be true of the freeway location and construction activities of the State Division of Highways, the work of the State Toll Bridge Authority, the activities of the U. S. Corps of Engineers, and the programs of the large number of subregional park, utility, and other special-purpose districts in the Bay Area. With the regional plan as a guide, and with these region-shaping development agencies being influenced by it, the physical development and control

activities of city and county governments would remain as they are today.

Accordingly, the regional plan is intended to focus only on the major issues of metropolitan physical development. Conversely, it is clearly intended that the plan should not attempt to guide cities and counties in meeting their local zoning and local capital improvement needs. Obviously, the main proposals of the regional plan will vitally affect the social and economic roles of the communities that make up the larger metropolitan community. It is equally obvious that city and county general plans may very well contain major proposals that are in conflict with the over-all scheme embodied in the regional plan. The proposed legislation assumes that the areas of agreement will far outweigh those of basic disagreement. Time and a tradition of creative compromise—which has been well established in the Bay Area, although it is not widely appreciated—will resolve most of the major disagreements, if local governments have and retain the balance of power in the field of physical development.

Major areawide needs should be identified, generally acknowledged, and reasonably provided for in the regional plan. If these important public requirements are ignored, year after year, the inability of local governments to meet these needs will become obvious, one at a time. When this stage is reached, local governments will either initiate, or consent to, the formation of additional areawide agencies, one at a time, to provide for proven needs. This is the approach that led to the successful establishment of the air pollution control and regional rapid transit agencies. This is the approach that could, if it is fairly understood, lead next to the establishment of a Bay Area regional planning agency.

Relationship to future metropolitan government needs.—The proposal recognizes that new areawide needs will emerge as the decades go by, and that areawide governmental organization to meet these needs will continue to evolve. While the special district for regional planning purposes appears to be the best vehicle for carrying out the regional plan-making function in the Bay Area at the present time, it is expected that some form of unified, representative metropolitan governing body, with control over several functions, will be established sooner or later. When this happens, it will be necessary to modify the form of regional planning organization specified in the district proposal.

If the regional planning district can be established during the next few years, however, there will be many beneficial results. The very nature of the regional planning process will be far better understood after the agency has had several years of experience. This experience should help everyone, particularly Bay Area legislators, to

identify the most appropriate legislative organization for dealing with metropolitanwide physical development problems, and should help to clarify—and limit—in specific Bay Area terms, the range of jurisdiction appropriate for a unified, limited-function metropolitan government.

The proposal provides for the adaptation of the regional planning district to meet changing conditions. The district board is given the duty of regularly reviewing its own effectiveness in relation to other existing and needed metropolitan governmental functions, and of reporting its conclusions and recommendations to the city and county governments and citizens of the Bay Area, and to the state Legislature.

* * *

The principal authors of the 1956 regional planning district proposal realized that the first attempt to draft specific legislation on this controversial subject naturally would not result promptly in the adoption of the initial proposal. Their main aim was to advance the debates on the subject to the next stage—to the level of definite ideas and practical politics. This is what has happened. The duties and governmental organization of the regional planning agency as set forth in the 1956 proposal may not stand up under the critical attacks to which the proposal is now being subjected. But the need to act on this important metropolitan problem, and the kinds of decisions that will have to be made, have been highlighted by the preparation and publication of the regional planning district proposal. The critics must now take the initiative.

Conclusions

The candidates of both major political parties during the 1960 presidential campaign issued statements expressing concern over the seriousness of the "metropolitan problem." Each party asserted that the federal government would have to become more directly involved in metropolitan affairs. In recent years, state governments have begun to reexamine their parental relationships with the local governments which they have created, and which are attempting, in the absence of any area-wide governments, to cope as best they can with metropolitan as well as local affairs. Metropolitan problems that have existed unnoticed for years have become critical and are now being talked about. New problems created by the tremendous growth of metropolitan regions everywhere in the world are forcing themselves into the public consciousness.

To experienced observers and to persons who have only recently become aware of metropolitan problems, it is apparent that these problems are serious. They are certain to become more complex and difficult in the years ahead. Some responsible authorities, and most of the newcomers to the current debates on the problems of the metropolis, say that a new crisis exists, and that "crash programs" are needed.

In my judgment, no new crisis exists, and any approach to the complex web of metropolitan problems in the Bay Area based on such an approach will surely fail. "Crash programs" can only be expected to solidify opposition to progress among the very groups who have the power to make progress possible.

In terms of the need for a regional plan for the Bay Area, and of the need for a permanently established regional planning program—well-governed, well-staffed, and properly financed—I believe that we have recently begun what will be seen in retrospect as a period of unfortunate delay and confusion.

Two things have happened that have disrupted the sustained post-war effort that was crystallized in the 1956 regional planning district proposal.

First, in 1961 the dominant local political leaders and professional advisers of the newly-formed Association of Bay Area Governments decided to attempt the impossible. They proposed, and they now have succeeded in obtaining support for, an effort to prepare a regional plan without a government to finance the task on a permanent basis, and without a visible and politically responsible policy group to control the plan. Without such a policy group directly charged with the responsi-

bility of making the difficult decisions that must be made, a useful regional plan cannot possibly be prepared. The Association's Executive Committee, its Regional Planning Committee, and its General Assembly are all voluntary groups. No one would expect them to prepare a regional rapid transit plan or regional air pollution control regulations. No one should expect them, or any voluntary group responsible to them, to make the controversial decisions that will have to be made when a useful regional plan is finally prepared.

Second, the intervention of the federal government after 1961 into metropolitan affairs on a massive scale, in terms of money, will, I believe, cause many things to be done in the name of progress that will actually delay the kinds of effort that are most needed. Federal grants will distract local leaders from making the difficult decisions that they themselves will eventually have to make before regional planning for the Bay Area can be established on an effective, permanent, locally financed, locally controlled basis.

In particular, I am thinking of the recent interest on the part of some legislators and their political and professional advisors in obtaining a very large grant of federal funds for the purpose of preparing a "comprehensive" transportation plan for the metropolitan Bay Area. Because of many factors, this four-million-dollar project probably will be carried out during the next few years on a "crash program" basis—less than ten years after the completion of the one-million-dollar crash program that produced the Bay Area rapid transit plan. In the Bay Area we no longer have to demonstrate to ourselves the need for a comprehensive regional plan by spending vast sums on additional piecemeal plans. This painful educational experience may still be necessary in New York, Boston, and Los Angeles; it is not necessary in the Bay Area. If we had to raise and spend our own money for this project today, we would not give it a second thought.

Local political and civic leaders will eventually have to set up, control, and finance a Bay Area regional plan-making agency themselves. They will eventually, I believe, have to combine this agency with the existing air pollution control and regional rapid transit agencies. And they will eventually have to add other regional agencies to these three—agencies to provide effectively for areawide needs that simply cannot be met in any other way. Until these hard tasks are undertaken, all other efforts will be diversionary.

The present period of confusion and continuing delay in facing the realities of the metropolitan physical development problems of the Bay Area will be seen in retrospect as an essential period of ferment, a necessary period of constructive, clarifying debate. The next

ten years are more likely to be characterized by the term "ferment," however, than by the term "constructive debate." It will probably be several years before local and state legislators have been educated sufficiently by the stubborn realities of the metropolitan problem to realize that there are great political opportunities (as well as the great dangers of which they are already aware) for the first political leader who chooses to take the initiative in working out serious, long-term proposals for the solution of this problem. Until this self-education has taken place, it is futile to expect or to hope for the kind of constructive debate that should and usually does precede successful legislative action.

Three definite steps could be taken at the present time that will help to clarify the basic issues. Each one will require patience. Each will be criticized for being too time-consuming, too methodical, too procedural. But if I am correct in judging the effectiveness of the veto power of Bay Area local governments, no quick and easy solution can be expected. The tortoise, not the hare, will be our mascot.

First, each city and county legislative body in the Bay Area that is ready to do so should appoint a "Citizens' Advisory Committee on Home Rule and Metropolitan Government." Critical self-analysis will lead to a willingness to act. It will also create a more confident awareness of the strength of local government, and of its capacity to solve many, but not all, of the Bay region's areawide problems by means of voluntary cooperation.

Second, the Governor and the Legislature should, with the consent of the Association of Bay Area Governments, establish a four-year Bay Area Metropolitan Problems Study Commission. Such a commission, a majority of whose members should be appointed by local legislative bodies, should be required at the end of its study to formulate a proposal for an effective metropolitan government suited to the particular needs and traditions of the Bay Area. No statewide approach will work.

Third, within each of the two major political parties a "local government group" should be formed as soon as possible. These groups should draft the planks in the California Republican and Democratic party platforms setting forth proposed solutions to the problems of metropolitan governmental organization suited to each of the two largest metropolitan regions of the state. The first party to face this issue and to work out a clear statement of policy that can be implemented by the Governor and state Legislature, with the consent of a substantial majority of the local governments in each metropolitan area, will gain a justified political advantage. There is already competition in the political arena at this level. It should be stimulated and nourished. The metropolitan problem—like the water problem—will not be solved

without rough controversy, without vigorous debate on proposed alternatives, and without forceful political action at both state and local levels.

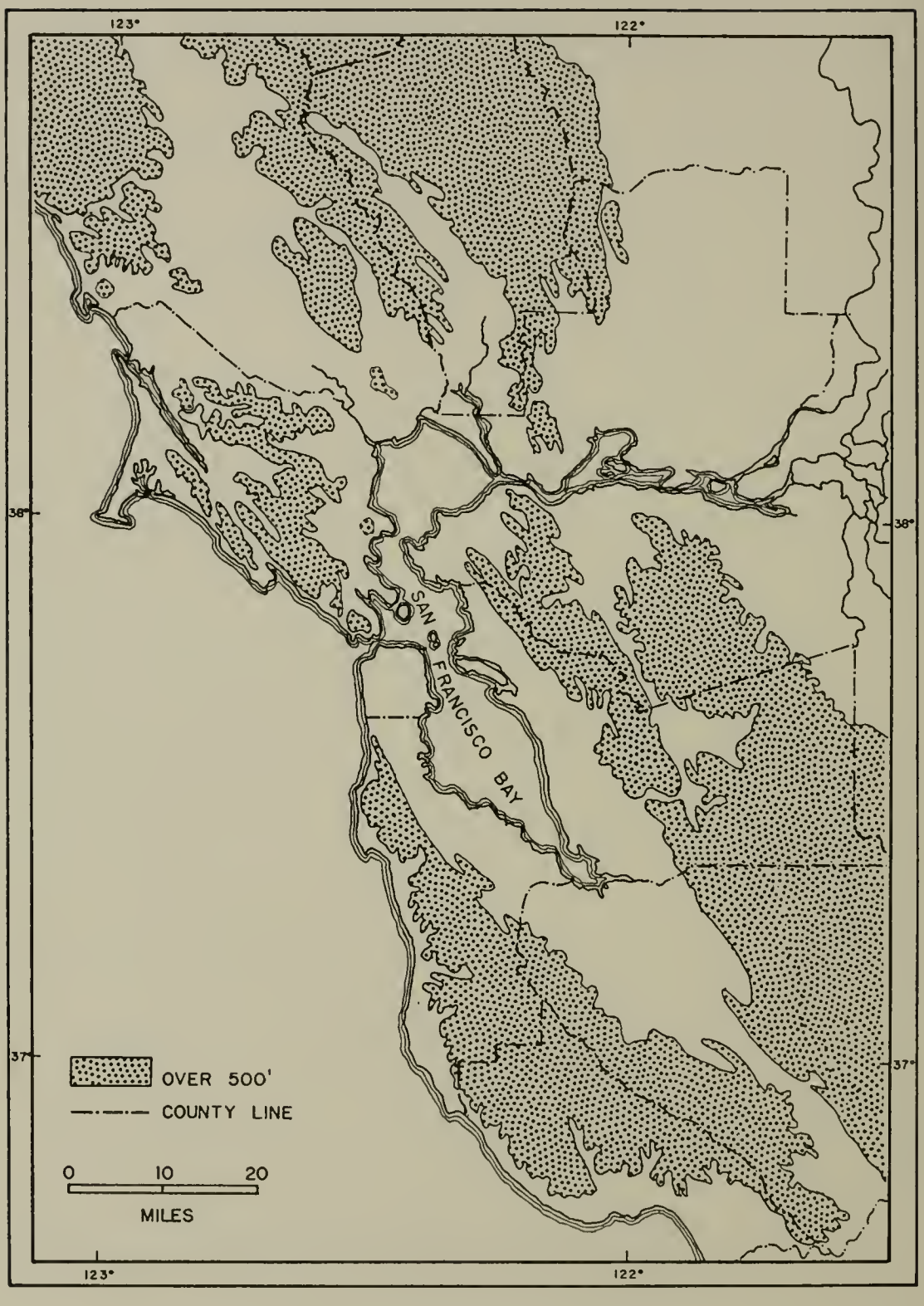
If the metropolitan problem is as serious as many observers claim it is, it may—at long last—receive the serious attention of both political parties in California during the 1966 gubernatorial campaign. It may, by that time, have become too serious to be ignored any longer. When that time comes we may expect action. Now is the time to prepare for it.

III

JOHN A. MAGA

AIR RESOURCE MANAGEMENT . . .

Air Resource Management in the
San Francisco Bay Area



Map 1: The San Francisco Air Basin

INSTITUTE OF GOVERNMENTAL STUDIES
University of California • Berkeley, California
DWIGHT WALDO, Director

Air Resource Management in the San Francisco Bay Area

By

JOHN A. MAGA

Chief, Bureau of Air Sanitation
California State Department of Public Health

1965

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Introduction

The San Francisco Bay Area has long been famous for natural beauty, magnificent vistas, and a salubrious climate. People in large numbers have moved here to take advantage of the mild and pleasant weather. View lots bring premium prices and individuals build hillside homes to enjoy the natural and manmade wonders. Tourists seek out the "skyrooms" to observe these same wonders.

Air pollution destroys many of these qualities that are so desirable and that give the area a unique appeal. The hills, the Bay waters, the bridges, and the night lights are too often obscured by a curtain of haze. Irritating chemicals in the air limit visibility, cause distress, and otherwise interfere with the full enjoyment of life. These effects stand in marked contrast to the pleasant climate and "picture window" view so much sought by newcomers and treasured by long-time residents of the region.

Air pollution problems have been observed in the Bay Area for many years. An early episode involved emissions from a smelter. This led to one of the classic investigations—the Selby Smelter Commission's Study, 1913–15—of damage to vegetation from sulfur dioxide, and to a solution of the problem. Over the years numerous other case histories of air pollution from dusts, odors and smoke have been recorded. Almost always these were instances of contaminants from single sources, affecting only limited areas rather than the region as a whole.

By 1950 it was clear that air pollution was no longer confined to locations near specific sources. Rather, the problem had become similar to that in Los Angeles: air pollution was affecting a large portion of the metropolitan region. Since then, a steady accumulation of evidence demonstrates that community-wide air pollution has developed into a major environmental problem of the San Francisco Bay Area.

The community has taken a number of important steps to cope with its air pollution problem and to reduce the quantity of contaminants discharged into the atmosphere. While much progress has been made, the Bay Area, like other metropolitan regions, finds the problem particularly difficult to solve. The difficulty of coping with air pollution problems is also attested to by the failure of yet other metropolitan regions in California, in the United States, and in foreign countries, to solve their air pollution problems. Their experience highlights the magnitude of the task and suggests the major efforts that will be required to prevent increasing pollution of the Bay Area's air resource.

Air Pollution in the Metropolis

Air pollution takes many forms and has varied and widespread effects: asthetic, biological, psychological and economic. It can affect man, vegetation and inanimate things. In its most serious manifestations, air pollution can cause human illness and death. Even in its least serious manifestations, it can still be a nuisance, causing unpleasant odors or soiling of surfaces.

The Causes and Their Effects

The substances that pollute air are even more varied than their effects. Many are common to all communities; some are of concern to only a few localities. Even within a single metropolitan region, some contaminants will affect the entire area while others will be of concern in only a portion of it. Dusts and smoke reduce visibility, cause deposits to appear on surfaces, and soil objects. Hydrocarbons and oxides of nitrogen react in the atmosphere to produce new pollutants and eye-stinging smog. These new pollutants in turn damage vegetation, reduce visibility and irritate the senses. Oxides of sulfur also damage crops, reduce visibility, corrode metals, and cause irritation. Hydrogen sulfide produces odor and discolors lead-based paints. Ethylene injures orchids and other ornamental plants.

Occurrence of any of the above effects may indicate the need for controlling air pollution. The most compelling basis, of course, is the need to protect human health. Although air pollution resulted in many deaths in London, the Meuse Valley, Belgium, and Donora, Pennsylvania, in most places it is difficult to demonstrate conclusively that polluted air either does or does not produce illness or death. One of the reasons for this is that air pollution does *not* produce a specific disease. Instead, if it results in illness, air pollution usually does so by aggravating diseases already commonly present in the community. Because these diseases also are caused and aggravated by elements other than air pollution, it is seldom possible to establish the exact contribution of each factor.

In California, however, irritation to eyes and respiratory systems has been so severe and widespread as to place air pollution in the category of a public health problem because of these effects alone.

In 1964, local health officers of the San Francisco Bay Area adopted a statement of air pollution control which stated, in part:

> Human instinct stirred by burning eyes, running noses should be heeded and these obvious warning afflictions should be a stimulant to action. Public Health

cannot wait for the obvious life-taking epidemics, it must support action while these threats are avertible. The more significant respiratory embarrassment already felt on badly smoggy days by many persons with serious allergic and cardiopulmonary diseases can be expected to worsen and involve a higher proportion of the population unless the steady rise in air pollution is halted.

A Local Problem Becomes Regional

In its simplest form, air pollution results when contaminants are discharged from a single installation. The source, the pollutants and the objectionable effects are easily detected, and the elements of the problem are readily understood. This kind of air pollution may be experienced anywhere—in a rural community as well as in a large city. Usually only a small area near the source is affected, rather than a metropolitan region as a whole.

In regional or community-wide air pollution, typical of metropolitan areas, contaminants spewed from thousands or millions of sources are intermingled in the atmosphere and may be transported from their points of origin to other parts of the community. In this kind of air pollution, it is seldom possible to relate the effects experienced by the community directly to specific compounds and their places of origin. Hence it is difficult to determine accurately the degree of control needed for each contaminant, or to forecast air quality improvements that will occur when emissions from any one of the sources are reduced.

California metropolitan areas were the first in the world to be troubled by a new and even more complex form of air pollution. Atmospheric wastes from numerous sources react, under the influence of sunlight, to produce *photochemical air pollution,* commonly called "smog." Original contaminants, inoffensive in the concentrations found in the atmosphere, react to produce new compounds which cause the adverse effects. It is now even more difficult to associate the effects noted in the community with the origin of the pollutants. Ozone, an important contaminant in the Bay Area, is an example of such a product. It is not discharged into the air directly, but is formed in the smog reaction of oxides of nitrogen and hydrocarbons.

California's problem, and that of the Bay Area, is made more critical by weather conditions which frequently permit the compounds to accumulate and react in the atmosphere, instead of dispersing rapidly. This new form of air pollution focused sharp attention on automobiles because they discharge large amounts of photochemical smog-producing substances. Attempts to control emissions from motor vehicles have required many departures from the usual methods used to attack other air pollution problems. This has meant new laws, additional agencies,

and much more emphasis on technical programs, research, and continuous measurement of contaminants.

Regional air pollution is of great concern because it directly affects millions of people who live and work in the metropolitan area. Vigorous efforts are usually made by the community to dispose of the wastes produced by human activities—for example, sewage and garbage—in a manner and at locations that prevent or minimize contact with the individual. Most people, even after living in a city for many years, do not know where the garbage dump or the sewage treatment plant is located.

Similar collection, treatment and disposal of atmospheric wastes at one or a few locations, however, is hardly practical. These wastes are discharged at their points of origin and may spread quickly throughout the community's air. A large segment of the population is thus exposed. The loss of visibility is there for all to see; the irritation to the eyes and respiratory system is there for most to feel. This widespread awareness may result in public indignation during severe smog episodes. Should contaminants be present in sufficient amounts to cause illness or death—as in London, for example—air pollution becomes a matter of deep concern to very large numbers of people.

The expansion of air pollution from a primarily local problem to one affecting an entire metropolitan area is a story of the industrial revolution, urbanization, and the increasing use of combustible fuels as energy sources. When a city grows, the needs for transportation, industry, heat and power also grow. The air pollutants produced in supplying these needs are concentrated in relatively small land areas where the dense populations are located. As the industrial revolution increased our capacity to produce goods and services, a steadily rising standard of living permitted the purchase of more goods, the consumption of more electricity, the ownership of more automobiles and the combustion of more fuel. As a result, the production of atmospheric wastes has increased even more rapidly than the population. The air pollution potential of urban areas has to be considered in the light of this harsh fact.

The Concept of Air Resource Management

Obviously it is not feasible, or even possible, to remove all of the contaminants from the atmosphere. Thus it is necessary to determine which substances the control effort will single out, as well as the degree to which the discharges will be curtailed.

Accordingly, air pollution control can be viewed as *management of the air resource* to achieve an acceptable balance among the many—often conflicting—demands upon the atmosphere. Maintenance of the Bay Area's air quality, permitting comfortable enjoyment of life, will require judicious use of air resources and careful control over the discharge of pollutants. Some of the more important elements which need to be considered in air resource management include: the volume of air available, the nature and quantity of wastes discharged, the present levels of contaminants and their effects, the anticipated increase in emissions, and the air quality desired by the community.

The science of air resource management has not progressed to a point where all of these factors can be defined accurately. It is not possible to establish the concentrations for all compounds at which undesirable effects can be expected. We still cannot precisely determine the volume of air that is available for the dispersal of wastes. Nor do we know how all the contaminants change or react in the atmosphere. But much information *is* available. The quantity of major pollutants discharged can be determined, the concentration of many contaminants measured, and objectionable effects identified and noted. The probable levels of future emissions can be estimated. From this information it is possible to draw conclusions regarding control efforts required to maintain good air quality.

Air Quality Standards

The effective management of air resources implies the existence of standards or goals through which the community expresses its desires with respect to the quality of air it wishes to have. Air quality standards may be used either to indicate the effects associated with given levels of pollution, or to define levels at which no objectionable effects are to be expected. Contaminant concentrations exceeding the accepted standards would be associated with undesirable effects, ranging from nuisances or injury to crops at a lower level, to possible effects on health at a higher level.

One use of air quality standards is illustrated by the equation: $C = \frac{Q}{V}$. (C represents the contaminant concentration; Q, the quantity of wastes; and V, the volume of air into which the wastes are disposed.) When C is higher than that specified by the air quality standard, either Q must be decreased or V increased if C is to return to an acceptable level. If V cannot be changed, then it is clear that the air quality standard defines the extent to which *the quantity of wastes must be reduced.*

Air quality standards applying to entire communities are a fairly new development in which California has pioneered. The State Department of Public Health first established such standards in 1959. Since then, interest in standards has spread throughout the United States and to other parts of the world. Because of inadequate data, only a relatively small number of pollutants have been included in the California standards. Even with these limitations, air quality standards have played an important role in the development of control measures. They have become, for example, the basis for a subset of additional standards applying to emissions from motor vehicles. The standards for vehicles, also set by the state health department, in turn defined the objectives of the state's control program for vehicular air pollution.

Although it would be desirable to have air quality standards for many additional contaminants and combinations of contaminants, this is not possible at present because the data required to support such standards are incomplete. Thus there is a clear need for research to obtain additional information on the effects of air pollution. As more and more scientifically valid air quality standards are established, communities will be better able to manage their air resources and design effective air pollution control programs.

Weather, Topography, and the Regional Air Resource

The air over the San Francisco Bay Area is contaminated in varying degrees from one day to the next. Although large quantities of pollutants are discharged daily, the maximum concentrations in the atmosphere vary considerably. Occasionally an unusually clean air mass moves into the region. For a day or two, everyone is aware of the sparkling clarity of the atmosphere: visibility may extend 30 miles or more, and distant landmarks and objects can be seen easily. In contrast, when air pollution episodes occur the visibility may be drastically reduced—even when there is no fog. Complaints about eye irritation will be heard, and farmers will suffer economic loss from damaged crops. Wide variations in air pollution levels are due primarily to fluctuations in the volumes of air available to receive and dilute pollutants. The quantity of wastes discharged is always about the same, although the rate of discharge does drop a little on weekends.

A Limited Air Supply

The presence of air pollution demonstrates that the Bay Area's air resource is often not adequate, i.e., the available air is unable to disperse satisfactorily the wastes presently discharged. The resource will be even less adequate for diluting the increasing amounts of contaminants that will be produced in the future, as the region continues to grow.

In contrast to water—which can be impounded and transported long distances—it is not feasible to bring additional air into an area by artificial means. When the demand for water in Bay Area communities exceeded local supplies, distant mountain sources were tapped. The City of San Francisco constructed dams on the Tuolumne River and its tributaries in the Sierra Nevada Range, and brought impounded waters across the Central Valley, through tunnels and under the Bay. The East Bay Municipal Utility District built dams on the Mokelumne River, also in the Sierra Nevada, and transported water into Alameda and Contra Costa counties. The California Water Plan will carry water originating in the northern portion of the state to places in Southern California as far south as San Diego. In all these instances it has been possible to increase the supply of water to metropolitan areas by impoundment and transmission facilities.

The quantity of air available at any given time is established by meteorological phenomena that are beyond man's control now and will remain so in the foreseeable future. No practical method is known for

artificially bringing new and clean air into metropolitan areas. Thus the people of the Bay Area must live in and dispose of their wastes into the supply of air that nature makes available. Already, the air resource has been abused in the Bay Area. This is made evident by the occurrence of air pollution episodes. Management of the Bay Area's air resource—the maintenance of air quality at satisfactory levels—can be achieved only by steps that *reduce the quantity of pollutants* discharged into the atmosphere.

The Effects of Wind

The air resources of an area and the ability of the air to dilute and disperse wastes depends upon wind movement and the stability of the atmosphere. Winds produce horizontal dispersion; stability determines vertical dispersion, i.e., the height to which the pollutants can be mixed. Strong winds and unstable conditions favor dilution of wastes in a large volume of air. Light winds and stable conditions permit contaminants to accumulate in a relatively small volume of air.

The velocity and direction of winds are strongly influenced by topography. In the Bay Area, the higher winds usually occur in the openings of the Coastal Ranges—the Golden Gate, San Bruno Gap and Carquinez Strait. The lighter winds are most likely to occur in the regions sheltered by the hills paralleling the coast and the eastern portion of San Francisco Bay. Given similar inversion conditions and emission of contaminants, locations having light winds experience the highest air pollution levels.

Table 1 shows the average wind speeds at several sites in the Bay Area for months selected to represent the four seasons of the year. Average wind speed varies considerably, depending on both season and location. The places with highest velocities have the best ventilation. The sheltering effect can be noted at San Rafael and Moffett Field.

TABLE 1
AVERAGE MONTHLY WIND SPEEDS AT SELECTED SITES
(MILES PER HOUR)

Month	San Francisco Airport[a]	Oakland Airport[a]	Moffett Field[b]	San Rafael (Hamilton Field)[b]
January (Winter)	6.9	6.2	5.8	5.5
April (Spring)	12.0	9.2	7.2	6.2
July (Summer)	13.7	9.0	7.6	6.3
October (Fall)	9.3	6.6	5.4	4.6

[a] U. S. Weather Bureau data for 29 years.
[b] Data for Moffett Field (U. S. Navy) and Hamilton Field (U. S. Air Force) for 7 years.

Although average wind speeds show the effect of sheltering and indicate the potential for air pollution, they do not reveal how often low wind velocities are experienced. The prevalence of light winds for extended periods is more important than average velocities in determining when contaminants may accumulate in the atmosphere. Frequently all parts of the Bay Area experience light winds. Often this occurs on warm, pleasant autumn days, or on cold and cloudless days in winter. Table 2 shows the percent of time the wind was below 4 miles per hour at several sites in the Bay Area for selected months representing the four seasons of the year. Data in Table 2 indicate that wind speeds are below 4 miles per hour for a large percent of the time, and that fall and winter are the seasons of lightest winds. At such times, therefore, air pollutants may not be effectively dispersed and air pollution episodes are most likely to occur.

TABLE 2
PERCENT OF TIME WHEN WIND SPEED IS LESS THAN 4 MILES PER HOUR AT SELECTED SITES

Month	San Francisco Airport	Oakland Airport	Moffett Field	San Rafael (Hamilton Field)
January (Winter)	27	45	37	46
April (Spring)	9	26	26	37
July (Summer)	14	22	24	35
October (Fall)	39	46	39	52

SOURCE: California, Department of Public Health, Bureau of Air Sanitation, *The Uses of Meteorological Data in Large Scale Air Pollution Surveys*, June, 1958.

Inversions in the Bay Area

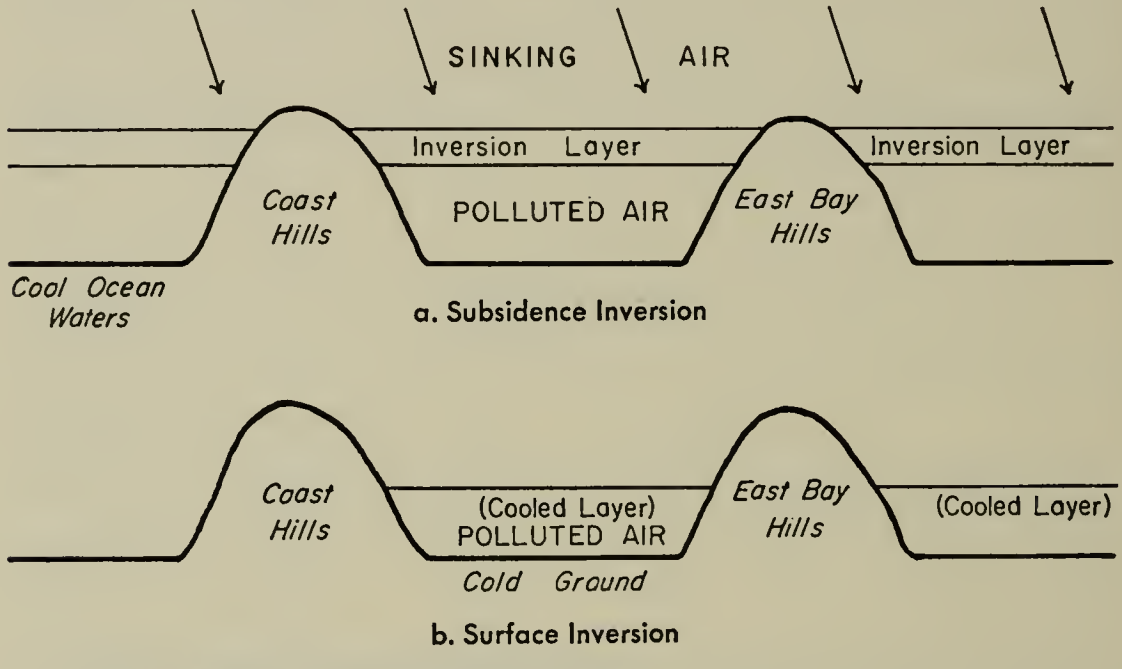
Bay Area weather is strongly influenced by a meteorological phenomenon which dominates the weather along the entire coast of California for much of the year. A semipermanent high-pressure cell located over the Pacific Ocean causes upper air along the coast and over the Bay Area to sink. This sinking compresses and heats the air, producing an overhead layer of warm air that is lighter than the underlying layers.[1]

[1] Semipermanent inversions formed over subtropical oceans characterize the west coasts of all continents, in the appropriate latitudes. The west coasts of Africa, South America, and the Iberian Peninsula, for example, have semipermanent inversions similar to California's. These regions are said to have a mediterranean type climate. See Donald H. Pack, "Meteorology of Air Pollution," *Science* 146:1119–1128, November 27, 1964.

At the same time, the air in contact with the earth is cooled by the relatively cold ocean waters. The combined heating aloft and cooling near the surface is responsible for the temperature inversion. The warm, light air above acts as a lid, trapping pollutants in the space below.

Two major types of inversions are found in the Bay Area. The subsidence inversion (Chart 1, a) is present during most of the year, except when winter storms move through the area. The elevation of

CHART 1: INVERSIONS IN THE SAN FRANCISCO BAY AREA



SOURCE: California Department of Public Health.

its base varies: it may be as much as several thousand feet above the ground or as little as a few hundred feet. Because only the air under the inversion is available for diluting pollutants, elevation of the base is significant. For example, an inversion base located at a height of 3,000 feet permits the discharge of six times the amount of pollutants allowed by an inversion only 500 feet high—given equal air quality standards and wind movement.

The Bay Area also experiences another type of inversion. On clear winter nights the earth cools rapidly and in turn cools the air near the ground. This causes a "surface" inversion (Chart 1, b). The base now is at the surface of the earth and the pollutants are confined in a shallow layer of air close to the ground.

Sunlight and Smog

Another important weather influence on the Bay Area's air pollution is the amount of sunlight. Many of the reactions between atmospheric contaminants are photochemical, i.e., require sunlight. The two types of inversion and the amount of sunshine determine the two basic pollution patterns experienced. Photochemical smog, with associated secondary pollutants produced in the photochemical reaction, occurs in the warm months during subsidence inversions and maximum sunlight intensity. Air pollution from unreacted or only partially reacted pollutants occurs in the winter, when there are surface inversions and sunlight intensity is low.

The Influence of Topography

Most of the region's residents live, work, and drive their automobiles in the elongated bowl-like basin formed by the hills bordering the Bay (see Map 1). The highest smog levels are found in this basin, both because of the concentration of human activities and because topography limits the volume of air into which wastes can be discharged. It was pointed out earlier that lower wind speeds result from the sheltering effects of the hills. Topography also modifies the direction of the wind, which in turn determines the pattern of pollutant transport.

The basin also influences the effects of inversions. Pollutants do not rise freely through the inversion layer, which may be viewed as an area-wide lid that varies in height from day-to-day. The volume of air available for waste disposal is greatly restricted when the inversion or "lid" is below the crest of the hills. A notion of this situation can be obtained from a glance at Chart 1.

Air Pollution and its Effects

Knowledge of present contaminant levels and the effects felt in the community is essential to air resources management. This information describes the current problem, and enables the community to locate its position on the curve of ascending air quality impairment. Such knowledge forms the basis for evaluating future air quality if the discharge of atmospheric wastes is not curtailed.

Reduced Visibility

One of the first signs of regional air pollution is the presence of a haze which markedly reduces visibility. In the Bay Area, this haze takes on a gray-brown appearance, and, during severe episodes, visibility may be reduced to one mile or less. Residents miss the clear view of the hills and cities across the Bay. Those living and driving near the top of the hills bordering the Bay or traveling in airplanes over the Bay Area can see that the haze is contained in a shallow layer of air. Above the haze layer, which is sometimes only a few hundred feet in depth, the air is clear and the visibility good. The loss of visibility often occurs during periods of pleasant weather—on days that are warmer than normal and accompanied by light winds, thus favoring the production of photochemical air pollution.

Haze and loss of visibility may be even more pronounced and conspicuous on cool winter days with light winds. In this instance the visibility impairment is caused not so much by photochemical reactions as by the confinement of smoke and dust particles near the surface of the earth.

Damage to Vegetation

Air pollution injury to vegetation has been recognized for more than a century. A number of compounds—among them fluorides, sulfur dioxide, chlorine and hydrogen sulfide—have been identified as causing damage of this kind.

In 1944 another kind of damage was first noted in the Los Angeles area. It resulted not from a specific identifiable contaminant, but from compounds produced in photochemical reactions in the atmosphere. Since 1950 this kind of vegetation injury has been experienced on a regional basis in the San Francisco Bay Area. It is characterized by a bronzing or silvering of the lower surface of the leaves of many plants. This kind of injury is frequently observed even before complaints of eye irritation are heard.

Still another type of injury affects ornamental plants in winter—orchids, snapdragons and carnations, for example. The injury involves the flower of the plant, and is caused by ethylene, a colorless and odorless gas produced in large quantities by motor vehicles, and in lesser amounts by other combustion and by the decomposition of organic materials. Very small concentrations of ethylene, under 0.1 parts per million by volume, can injure ornamental plants. (Paradoxically, ethylene also has the property of accelerating the ripening of fruits and vegetables: in small quantities it is used to mature the color of certain fruits.)

In some years, commercial growers of ornamental plants have been unable to market much of their crop because of flower damage from ethylene. Financial losses have led some growers to consider moving their operations from the Bay Area. The Bay Area Air Pollution Control District estimates that losses due to crop damage from all air pollutants reach several million dollars per year.

Personal Discomfort

To the public, eye and respiratory irritation is the most objectionable effect of photochemical air pollution. It draws the greatest number of complaints, and has been experienced by Bay Area residents and visitors alike during smog episodes.

The California State Department of Public Health has evaluated the extent of discomfort from air pollution in California in order to learn about its effects on individuals. Approximately one third of the people questioned in the Bay Area recently reported that they were bothered by air pollution. In a similar survey in 1956, one quarter of the people questioned had said they were affected. In contrast, three-fourths of the people in Los Angeles reported in both surveys that air pollution had caused them discomfort.

But the Bay Area cannot derive very much satisfaction from its lower levels of air pollution, because the findings indicate that over one million Bay Area residents may suffer pollution-caused discomfort. And even more disquieting is the fact that the southern California experience demonstrates the potential for *future* levels of pollution and discomfort in the Bay Area as growth proceeds.

Pollutant Concentrations

Human sensory data are valuable indicators of the extent of air pollution, but they do not define the concentrations and compounds present. Many pollutants produce no sensory effects. Data obtained by measur-

ing the concentration of contaminants, therefore, are needed to establish accurately the levels of pollution and to determine if the levels are increasing. Unfortunately, however, data on atmospheric contaminants in the Bay Area are limited in both the number of compounds that have been measured and the locations where measurements have been made. Better information on the kinds and concentrations of pollutants is essential to a more complete evaluation of air quality. Existing air monitoring activities will have to be expanded to include additional compounds and more sampling sites.

Data on oxidant and carbon monoxide at Berkeley are plotted in Chart 2. The diagram shows that the concentration of these compounds vary during the year and that the two curves do not follow a similar pattern. Each plotted value represents the average of the maximum concentration for the given month for the period 1956–1962. Because oxidants are formed in the smog reaction, they are higher in summer and fall during periods of increased photochemical smog. Carbon monoxide levels are highest in winter when surface inversions are present. These seasonal patterns for oxidant and carbon monoxide have also been observed in other metropolitan regions of California.

Most of the available data on air quality in the Bay Area relate to oxidant levels, which serve as a measure of photochemical smog. Oxidant concentrations of 0.15 parts per million (ppm) by volume represent approximate smog levels at which slight eye irritation is experienced, oxidant type injury occurs to vegetation, and visibility impairment can be expected. Oxidant concentrations of 0.25 ppm and above indicate a severe air pollution episode, accompanied by widespread eye irritation and restriction of visibility to short distances. These facts, which have been established by investigation and air monitoring, lie behind the state's air quality standard for photochemical smog.

Oxidant values well above the State Department of Public Health's air quality standard of 0.15 ppm for one hour have been reached in each of these counties: Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Santa Clara. In general, the higher values and most frequent occurrences are found in mid-Alameda County and mid-San Mateo County, a pattern that is determined largely by meteorological and topographic factors. Other contributing elements are the density of population and levels of human activity in these areas.

The maximum oxidant concentration thus far recorded in the Bay Area is 0.37 ppm, as compared with 0.75 ppm in Los Angeles. This would indicate that peak photochemical smog levels in the Bay Area are about one-half those in Los Angeles. Maximum carbon monoxide

Above: A clear day affords good views of San Francisco and the Golden Gate from slopes overlooking the University campus in Berkeley

Below: Air pollution obscures the view from Twin Peaks looking northeast across downtown San Francisco toward the Berkeley hills

Views from the University Campanile

Left: Looking west on a clear day, campus buildings in the foreground

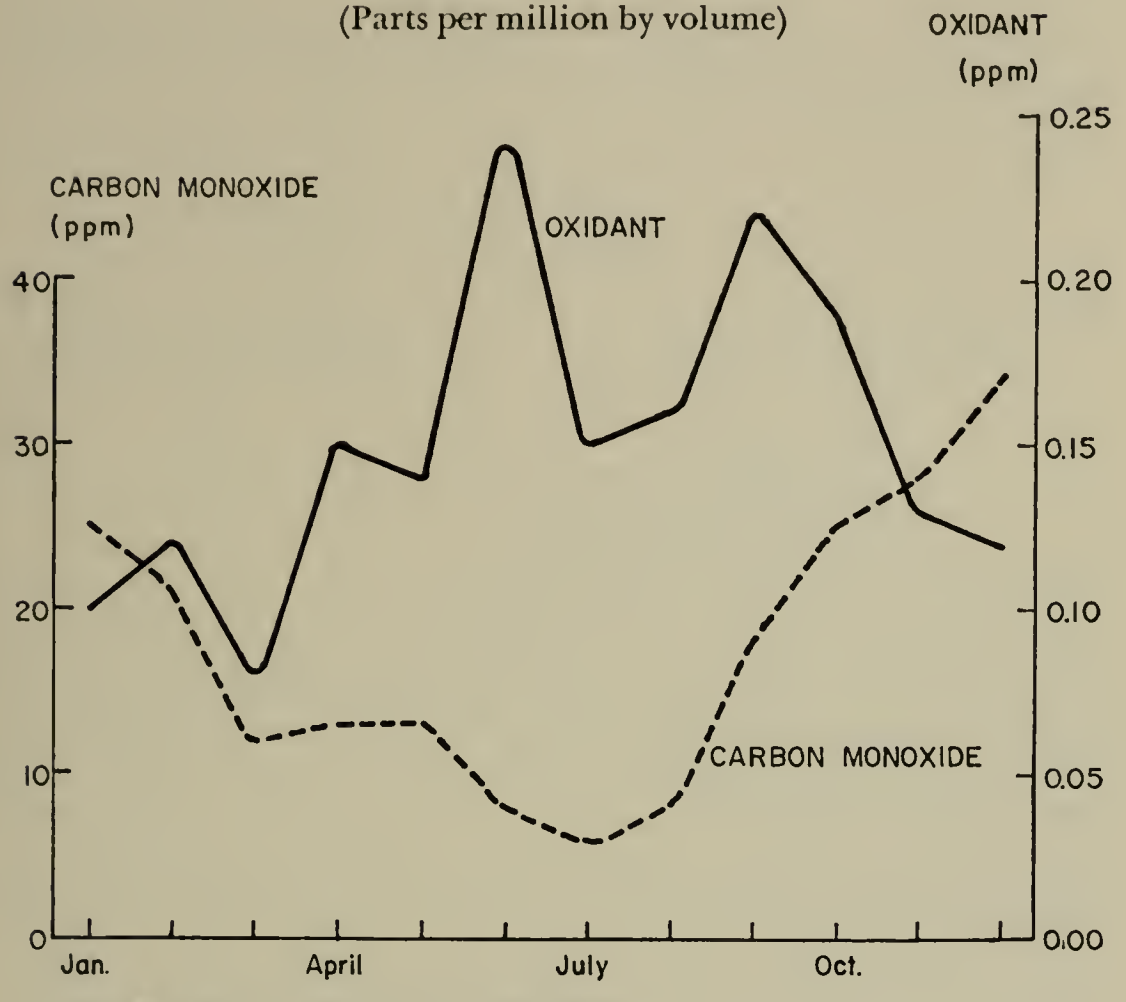
Above: Looking west during an air pollution episode

Below: Looking south toward Oakland, same day

Above: A day of maximum visibility—air view westward over Lake Merritt and downtown Oakland toward Yerba Buena Island, San Francisco and the Pacific Ocean

Right: Air pollution fills the basin in this southwesterly view across a nearly invisible Oakland toward the ridge of San Matea Peninsula

CHART 2: CARBON MONOXIDE AND OXIDANT CONCENTRATIONS IN BERKELEY, 1957 TO 1962
(Parts per million by volume)



SOURCE: California Department of Public Health.

concentrations in Los Angeles have also been approximately twice those in the Bay Area. However, the number of days of high air pollution are much fewer in the Bay Area than in Los Angeles.

But severe air pollution episodes do occur in the Bay Area, as experience in September and October, 1964, clearly demonstrated. This period was characterized by a number of days with higher than normal temperatures, and by weather conditions that were very favorable for photochemical smog. In several places the levels of oxidant, as well as other pollutants, were among the highest that have ever been registered in the Bay Area. Eye irritation was widespread and visibility was sharply reduced.

A summary of oxidant values in the Bay Area for 1962 is given in Table 3. It shows the number of days when the State Department of

Public Health air quality standard of 0.15 ppm was exceeded at one or more places in the area, the number of days when the oxidant value was 0.25 ppm or above (severe smog episode) at any site, and the number of days when the oxidant equalled or exceeded 0.10 ppm for a period of one hour at any site. This table indicates that in 1962 the standard was exceeded on 39 separate days at some place in the Bay Area.

TABLE 3
SUMMARY DATA ON OXIDANT CONCENTRATIONS IN THE SAN FRANCISCO BAY AREA, 1962

Oxidant Concentration (parts per million-by volume)	Number of days on which level was reached or exceeded
0.35	1
0.25 and above	11
0.15 and above for 1 hour	39
0.10 and above for 1 hour	114

SOURCE: Bay Area Air Pollution Control District.

Present levels are only a part of the information needed for a successful program of air resource management. Consideration must be given to the potential problem posed by continued growth. Oxidant values of 0.10 ppm, while generally not representing levels of discomfort, indicate the presence of photochemical smog. It is safe to assume that as the region grows, and if adequate control programs are not undertaken, air pollution episodes will occur more often and be more severe. Thus the 114 days in 1962 when oxidant levels reached 0.10 ppm are only a portent of things to come if growth continues. One would conclude from the data that conditions are favorable for the formation of photochemical smog more than 100 days each year. With continued growth, control of emissions is required if this potential is not to be realized.

Many materials other than oxidants reach high levels. For example, high carbon monoxide concentrations occur in the colder months of the year when oxidant is usually low. Measurements taken at Berkeley over a period of about five years indicate that, in winters with frequent ground level inversions and light winds, carbon monoxide concentrations of 25 ppm or more might be expected on over 25 days. Thus, in some years there probably is a total of more than 125 days with conditions favorable to the accumulation of various kinds of pollutants. This represents about one day in every three. Similar estimates can be obtained by considering the number of days when low inversions and light winds occur together. The prevalence of light winds in the Bay

Area, as shown in Table 2, also demonstrates the potential for frequent air pollution episodes.

Bay Area Growth and Increasing Air Pollution

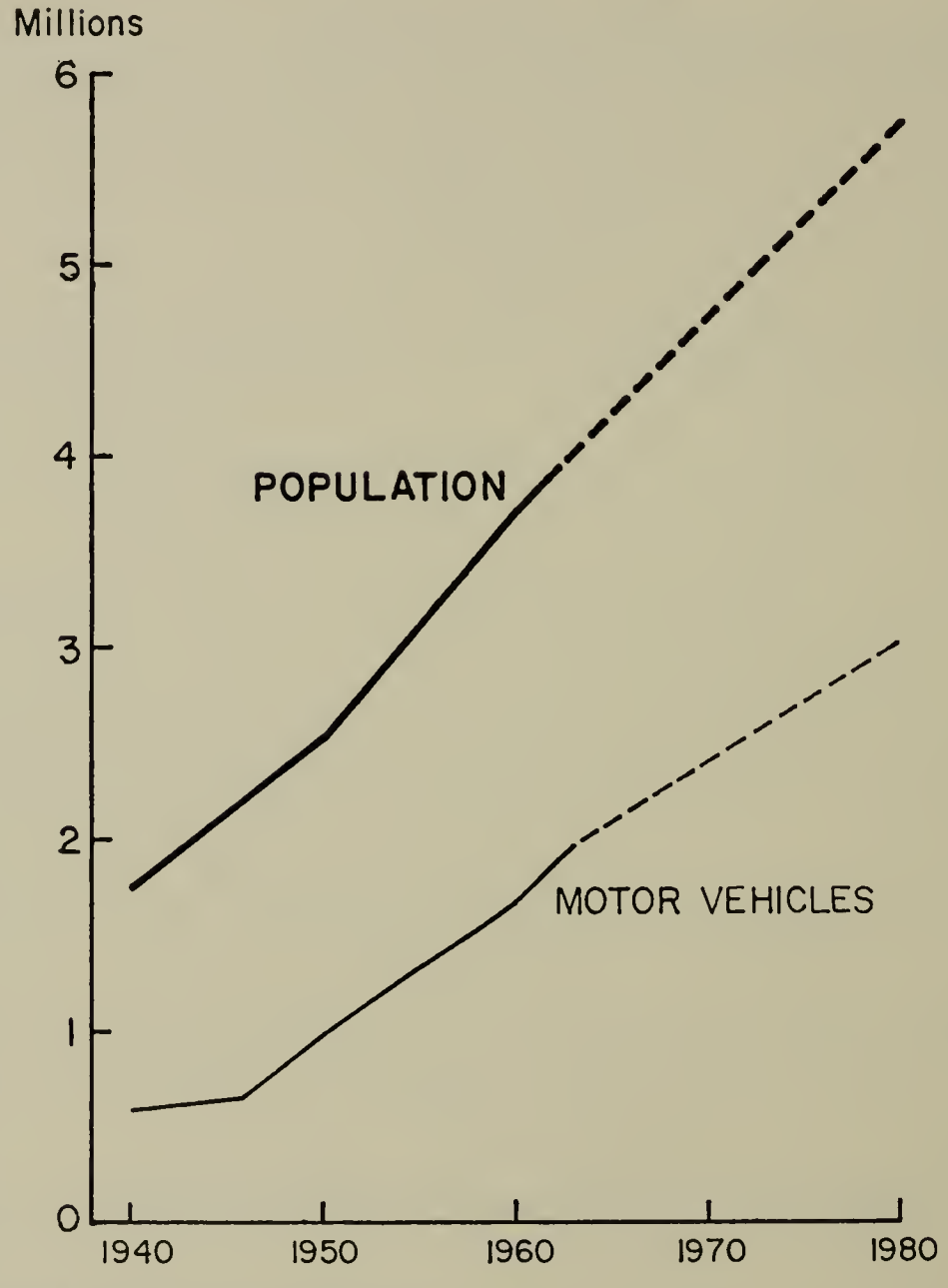
Much has been written and said about the growth of California and its metropolitan regions. This subject is of particular significance in air pollution because the quantity of pollutants discharged to the atmosphere is closely related to human activity.

Population and motor vehicle registration in the nine Bay Area counties are indicated in Chart 3. Past growth is shown and future growth projected. This information, in turn, helps us to get a picture of the potential air pollution problem if contaminants are not controlled. As the figure indicates, the 1960 population was 3,774,000; vehicle registration was 1,685,000. In 1980 the Bay Area is expected to have a population of about 5,700,000 and about 3,000,000 motor vehicles.

The Los Angeles experience gives some inkling of the meaning of these growth projections. Comparisons must, of course, be tempered by an awareness of the differences between the areas compared. Even with this reservation, however, the parallel between the San Francisco Bay Area and Los Angeles seems obvious. The dates of initial smog observations in Los Angeles and San Francisco, and the growth patterns of population, automobiles and industry, all suggest that the Bay Area is repeating the air pollution history of the metropolis to the south. Chart 4 compares population and vehicle registration in Los Angeles County and the Bay Area. Different horizontal scales are employed so that the 1940–1960 growth in Los Angeles can be compared with that for 1950–1980 in the Bay Area. It can be seen that in 1980 the population and number of automobiles expected here will be similar to those present in Los Angeles County in 1960. The potential for air pollution should be similar if other conditions are about the same.

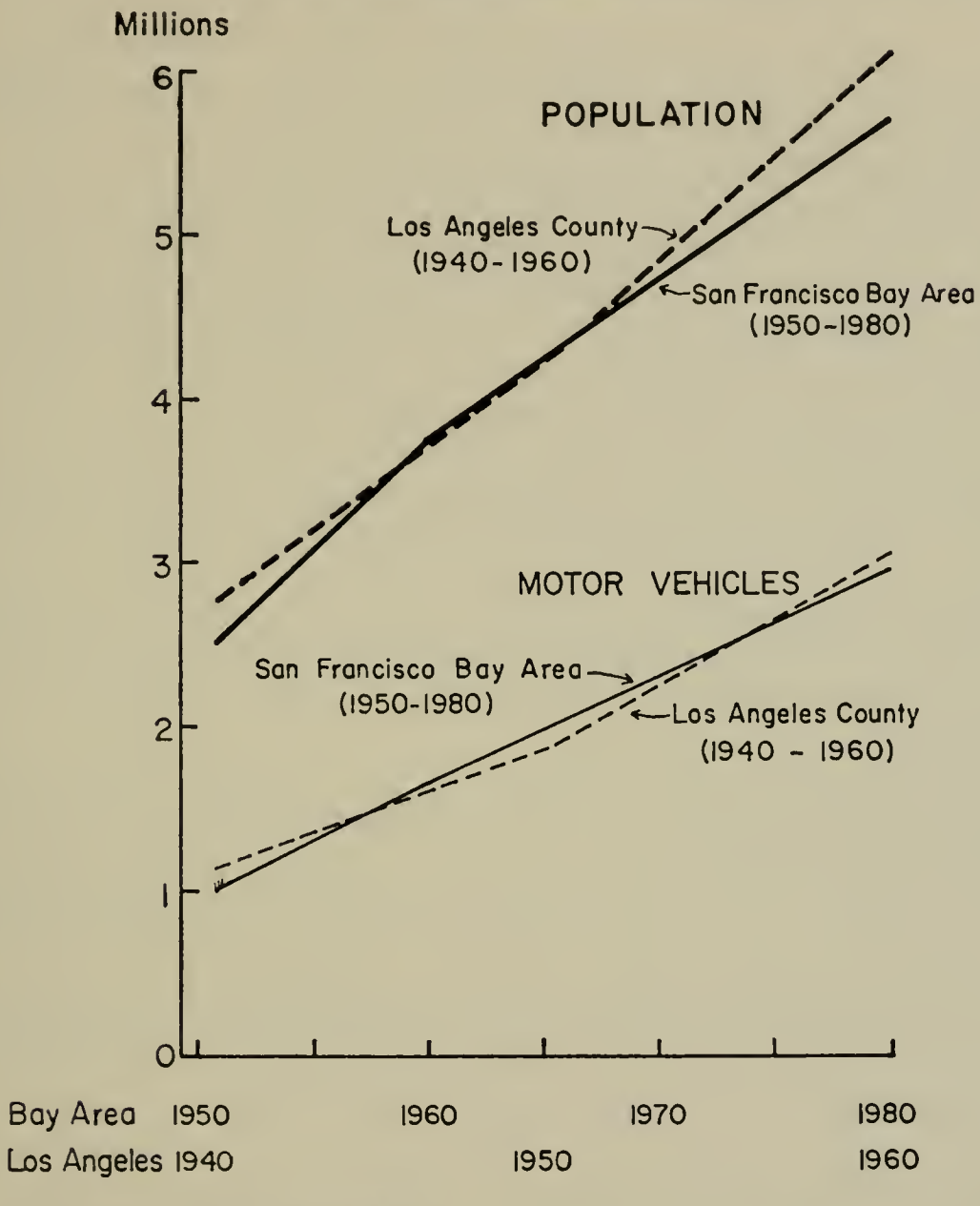
Much of the future growth is expected to take place in San Mateo, Santa Clara and southern Alameda counties. Because of this fact, and meteorological conditions, it is anticipated that these portions of the Bay Area will continue to be most seriously affected by air pollution. Moreover, continued growth means that other sections of the Bay Area not now experiencing serious pollution can expect smog episodes. This is especially true where the growth is occurring in places not now densely populated, for example, central Contra Costa County and Eastern Alameda County.

CHART 3: POPULATION AND MOTOR VEHICLES IN THE SAN FRANCISCO BAY AREA, 1940 TO 1980



SOURCES: U. S. Census of Population.
California Department of Motor Vehicles.
California, University, Institute of Governmental Studies, *Future Demographic Growth of the San Francisco Bay Area;* by Kingsley Davis and Eleanor Langlois, 1963.

CHART 4: POPULATION AND MOTOR VEHICLES: THE BAY AREA COMPARED WITH LOS ANGELES COUNTY



SOURCES: U. S. Census of Population.
California Department of Motor Vehicles.
California, University, Institute of Governmental Studies, *Future Demographic Growth of the San Francisco Bay Area;* by Kingsley Davis and Eleanor Langlois, 1963.

Air Pollution and Its Relationship to Other Regional Problems

Air pollution is a particularly difficult problem to resolve because it is so closely related to a variety of human activities and pursuits. The manner in which many of these activities are carried on has a profound effect on the air pollution problem and its control.

Management of the air resources of the Bay Area, therefore, must be concerned with more than regulations directed at individual sources. The entire growth of the region, the number of people per square mile, the method of power generation, the type and location of industries, and the traffic and transportation pattern will have far-reaching effects on the extent and severity of future air pollution.

The quantity and nature of contaminants in the atmosphere will depend upon the kinds of industries which come into the area, and their location. Generation of electrical power by combustion of fossil fuels will produce pollutants; transmission of hydroelectric power from distant sources results in no pollutants. Generation of power by atomic energy would produce few contaminants that cause visible plumes or photochemical smog, but problems of reactor location and safety would be raised.

In many cases it will not be possible to accomplish both of two desired objectives. For example, the prohibition of open burning and the minimum use of land for dumping are mutually exclusive. But the broad implications of interrelated actions will require closer attention as the Bay Area continues to grow and its problems become more difficult. The air pollution control agencies are obviously not the only ones concerned with these problems. Other groups and agencies which make decisions on how the area develops must also be engaged in air resources management.

Significance of Small Sources

Most previous efforts to control atmospheric wastes have been directed primarily at industry. But more and more it is being recognized that air pollution in metropolitan regions also results from the large numbers of smaller sources of pollutants. In London it has been concluded that the primary source of sulfur dioxide and smoke is the burning of coal by householders. In California a very large number of small sources—individual automobiles—have created an air pollution problem of great magnitude. Contaminants emitted from the automobile

have been recognized as the most important cause of photochemical smog. Both in London and in California's metropolitan areas the problem can be attacked effectively only if these many small sources are included in the overall control effort.

Refuse Disposal

Useful measures that can be taken against air pollution often present a threat to old practices and procedures. This is well illustrated by refuse disposal. At one time, open dump burning produced smoke and odors at numerous points along the Bay, and one could see many columns of smoke rising from these operations. Banning of open burning on these dumps was a proper and necessary action for air pollution purposes; yet this met with opposition from some cities and dump operators. Prohibition of open burning has made it necessary to seek alternate and more costly methods to dispose of combustible materials from commercial, industrial and governmental installations, as well as of demolition debris from freeway construction and redevelopment projects.

Air pollution regulations apply to emissions from municipal and commercial incinerators. Again, these regulations are needed for air pollution purposes. But the use of incinerators designed for good or near-complete combustion, and to prevent the discharge of particulates, makes it more expensive to dispose of combustible materials. In the Bay Area, as well as in other parts of California, communities usually have not used incinerators to comply with air pollution regulations. Instead, they have disposed of refuse in sanitary land fills. This requires more land, already in short supply, for the filling operation.

Backyard burning also produces pollutants. Regulations banning this practice would make it necessary to have refuse collection and disposal services now not available in most Bay Area communities. Obviously, the collection and disposal service could be made available only at added cost to the householder. Questions will be raised as to how this service should be provided. Should it be by private scavengers or by government? Burning of agricultural wastes, a time-honored farming practice, also adds products of incomplete combustion to the air. Alternate means of disposing of these wastes are not always available at low cost.

Improper sewage and industrial waste practices lead to air pollution problems. For example, odors in the south Bay Area result from decomposition of liquid and solid organic wastes. Liquid wastes together with garbage have produced similar problems at Candlestick Point. And those who have lived in the Bay Area for a long time will recall the odor

along the Berkeley and Emeryville shores prior to the construction of sewage collection and treatment works for the communities in the East Bay.

Transportation and the Motor Vehicle

The pattern of transportation and automobile use in the metropolis has profound implications for the problem of air pollution, because motor vehicles are the most vital factor in California's urban air pollution problems. Cars are present in huge numbers; they are a part of our way of life; they are highly mobile; and their emissions are difficult to control. But the solution of the air pollution problem of the Bay Area, as in other California urban areas, will require effective control of automobile emissions.

The presence or absence of a rapid transit system has an influence on air pollution. Although it would be unrealistic to declare that rapid transit service for the nine Bay Area counties would eliminate the need to control emissions from vehicles, an effective transit system could reduce the use of private automobiles in downtown areas and, in turn, reduce air pollution levels there. Further, vehicular traffic should be made to flow as freely as possible, without the frequent stops and starts that increase exhaust emissions. Once again, this would not do away with the need for the control of motor vehicle emissions, but it would speed the movement of traffic and result in lower exhaust emissions from automobiles.

A Regional Approach to the Control of Air Pollution

In 1947 the State Legislature enacted enabling laws permitting the formation of county air pollution control districts. Such districts now exist in seven California counties: Los Angeles, San Diego, San Bernardino, Orange, Riverside, Sacramento and Humbolt.

Santa Clara County first recognized the potential for a Bay Area problem, and established an air pollution control district in 1948. Within the next few years other Bay Area counties acknowledged that action was necessary, but concluded that a uniform approach throughout the Bay Area was required. As a result, in 1955, the State Legislature created a regional air pollution control district covering the nine counties bordering San Francisco Bay, as shown in Map 2. This district became the first regional government in the Bay Area, and is the only regional air pollution control agency in the state.

With the creation of the Bay Area Air Pollution Control District, the Santa Clara County district was dissolved. Also, the Legislature provided that each of the three northern counties—Sonoma, Napa and Solano—need not be active participants until their individual boards of supervisors adopt implementing resolutions. None of the three counties has taken this action to date, and the district now operates in six counties: Alameda, San Francisco, San Mateo, Santa Clara, Contra Costa and Marin.

It is generally agreed that individual districts in each county would have been undesirable because of the clear need for a unified, multi-county central program. But does a *nine*-county district constitute a logical organizational basis for uniform air pollution? The answer is "yes." Air resource management requires a regional approach if the sources of pollution and the areas affected thereby are to be considered together. These conditions can never be met completely, because winds blow across all geographical or political boundaries. But the Bay Area Air Pollution Control District does represent a reasonable compromise which recognizes the regional facts of life: the air quality of the Bay Area is primarily determined by the sources within it.

Man-made pollutants, except for radioactive materials from atomic bomb testing, are not brought into the area by the winds that flow over the Pacific Ocean, and significant amounts of contaminants are not often carried into the Bay Area from other parts of the state. Within

MAP 2: THE BAY AREA AIR POLLUTION CONTROL DISTRICT—
ACTIVE AND INACTIVE COUNTIES

the district, however, atmospheric wastes from one county frequently affect areas in other counties.[1]

One of the main purposes of an air pollution control agency is to provide a means for adopting and enforcing uniform laws and regulations to control emissions into the atmosphere. There are over 65 incorporated cities in the Bay Area Air Pollution Control District's six active counties—in the nine counties there are more than 80 cities. Without a regional agency it would be difficult if not impossible to institute similar regulations and achieve a uniform level of enforcement.

The district embodies a unique formula giving representation to both the city and county governments. The governing board consists of two individuals from each county—one is from the board of supervisors and the other is chosen by the mayors of cities in the county, from among the mayors and city councilmen of that area. This arrangement also provides a means of relating the district's program to those of the individual cities and counties.

The Bay Area Air Pollution Control District, therefore, is a logical and practical govenmental agency for attacking the air pollution problem of the region. Until Solano, Napa and Sonoma counties become active participants, however, the district cannot plan and take action on a fully regional basis.

[1] Portions of the district that least meet the requirement that air pollution sources and affected areas be considered together are the eastern parts of Contra Costa, Alameda and Solano counties. The meteorology and geography of these areas resemble those of the Central Valley rather than the area around San Francisco Bay.

Control Programs in the Bay Area

Air resource management requires a determination of which sources should be attacked and what degree of control will be required. Contaminants are discharged from a large number of sources and in a variety of places; the pollutants are not all of the same importance. If the community desires the best possible air quality, the number of emissions attacked will be high, as will the degree of control evoked.

The more obvious sources, such as open dump burning, black smoke from chimneys, and pollutants that cause nuisances or health hazards usually receive first attention. Non-visible compounds cannot be neglected, however, for they are often even more important than those which can be seen. The compounds in auto exhaust that cause the greatest concern, for example, are non-visible gases and vapors.

To a large degree regional air pollution is the consequence of fuel combustion—of burning processes for heating homes and offices, carrying out industrial activities, powering automobiles, generating electricity, and destroying unwanted waste products. Combustion, therefore, is the main item to be considered in air resource management.

The California Legislature has given both the state and the Bay Area Air Pollution Control District responsibility for the control of air pollution. The State Department of Public Health establishes standards for air quality and for the emissions from motor vehicles. The State Motor Vehicle Pollution Control Board tests and approves devices or systems for the control of automotive pollutants. The regional air pollution control district has jurisdiction over non-vehicular sources. Under present law the district has the power to decide whether it will require state-approved vehicle pollution control devices on used automobiles, and whether to have vehicle pollution inspection stations in the Bay Area. It does not have the power to determine whether and when such devices are to be placed on new cars. Changes in requirements for installing control devices on used cars are under consideration by the 1965 Legislature.

Vehicular emissions came under the control of the state when the California Legislature concluded that it was impractical for local or regional agencies to deal effectively with the problem. Automobiles move freely across political boundaries; they are registered and licensed by the state; and they are a major cause of air pollution in all of California's metropolitan regions.

Non-Vehicular Sources

Both the Bay Area Air Pollution Control District and the state are in the early stages of developing comprehensive control programs. The district has adopted two regulations on the discharge of atmospheric wastes. District Regulation No. 1 bans open burning—exceptions being rubbish fires made by individual home owners, burning of most agricultural wastes, recreational fires, and fires set for safety purposes or to control disease in vegetation. Regulation No. 2 is primarily concerned with the discharge of smoke, particulate matter and sulfur dioxide from industrial, commercial and municipal operations. This regulation, which is the heart of the district's present program, covers thousands of sources. Examples of contaminants and installations subject to the regulation include: smoke and dusts from steel mills, foundries, cement plants and hot asphalt plants; smoke from boilers and power plants; smoke and particulate matter produced in the incineration of combustible wastes by supermarkets, schools, apartment houses and cities; and sulfur dioxide from industrial operations. Installations that come under these regulations have taken or are taking steps to comply; the district currently is placing strong emphasis on enforcement of these requirements.

Because the air pollution problem is far from being solved, it is easy to overlook the very real contribution and progress made by the district. A substantial part of this progress lies in preventing large quantities of objectionable substances from entering the air. The most obvious result of Regulation No. 1 is the absence of dense clouds of smoke which a few years ago could be seen rising from the many open-burning dumps in the Bay Area. A great deal of smoke and other products of incomplete combustion have thus been eliminated by the ban on open burning at municipal, commercial, and industrial installations.

Under the district's Regulation No. 2, numerous industries have been required to install control equipment limiting emissions to specified levels. Compliance with this regulation involves the use of high-efficiency collection systems, good combustion practices and well-designed incinerators. The regulation is as strict as those of the Los Angeles County Air Pollution Control District covering similar emissions, which have been considered the most strict in this country. Due mainly to lack of staff, however, Bay Area enforcement efforts are less effective than those in Los Angeles. Nevertheless, Regulation No. 2 has already eliminated much smoke and hundreds of tons of other par-

ticulate matter that once discharged daily into the atmosphere. Benefits have been numerous: many visible plumes have disappeared; particulate matter is not deposited in areas surrounding controlled installations; and large amounts of visibility-reducing particles are no longer dispersed in the atmosphere.

Although regulations have not been enacted for hydrocarbons, progress has been made in the control of these compounds through a voluntary program involving all of the oil refineries. The air pollution control district has also been instrumental in resolving problems of nuisance or damage to property in areas near sources of air pollution.

Motor Vehicles

The importance of motor vehicles in the air pollution problems of California's metropolitan regions was discussed earlier. Vehicular contaminants of chief concern are hydrocarbons, oxides of nitrogen, and carbon monoxide:

TABLE 4
MAJOR POLLUTANTS FROM GASOLINE-POWERED AUTOMOBILES

Source	Pollutants	Percent Contributed by Each Source (Approximate)
Exhaust	Hydrocarbons	60
	Carbon Monoxide	99
	Oxides of Nitrogen	99
Crankcase	Hydrocarbons	25
	Carbon Monoxide	1
	Oxides of Nitrogen	1
Fuel Tank	Hydrocarbons	6
Carburetor	Hydrocarbons	9

Table 4 indicates that the motor vehicle discharges pollutants from four sources—exhaust, crankcase, fuel tank and carburetor. Automobile exhaust contains most of the hydrocarbons, as well as almost all of the oxides of nitrogen, and carbon monoxide. Crankcase, fuel tank and carburetor emissions are, in effect, limited to hydrocarbons.

Only recently has any attempt been made to do something about emissions from automobiles. As was noted earlier, the State of California is now pioneering this effort. As requested by the Legislature, the State Department of Public Health has set standards on motor vehicle emissions—these are the only such standards in existence any-

where. They cover hydrocarbons in crankcase, exhaust, fuel tank and carburetor emissions, as well as carbon monoxide in exhaust gases. Hydrocarbons are of concern because they undergo reaction in the atmosphere. Carbon monoxide is not involved in the smog reaction, but is a toxic compound that interfers with oxygen transport by the blood.

The control of motor vehicle emissions is a difficult problem, but notable progress has been made. Crankcase hydrocarbon control devices, approved by the State Motor Vehicle Pollution Control Board, are now required on all *new* cars registered in California. In 1963 the Bay Area Air Pollution Control District took action requiring these devices on *used* vehicles. During 1964, crankcase control devices were installed on used commercial vehicles and private cars when there was a transfer of ownership. As was mentioned above, the 1965 Legislature is considering changes in the law dealing with crankcase device requirements for used cars.

But crankcase control devices will only take care of about one quarter of the hydrocarbons emitted by the automobile. Thus controls will be required for exhaust, fuel tank, and carburetor hydrocarbon losses. Currently a great deal of work is being done on methods to reduce monoxide and hydrocarbons from engine exhaust. The Motor Vehicle Pollution Control Board has been testing and evaluating a number of exhaust control devices; in June 1964 it approved four of these for new cars only. Thus a start on the actual control of exhaust emissions will soon be possible. In March 1964, the Automobile Manufacturers Association announced that new American-made cars, starting with the 1967 models, will be equipped with systems to reduce exhaust hydrocarbons and carbon monoxide. And in August, 1964, automobile industry representatives, responding to pressure from California, moved the date ahead one year, indicating that the 1966 models will be equipped with control devices. These controls, it should be noted, will not be available for 1966 model foreign-made vehicles and large trucks.

Control methods for fuel tank and carburetor emissions have not progressed to the point where they can be installed on cars. But automobile emission standards set in 1964 will stimulate the development of controls for these sources. Emission standards for oxides of nitrogen in exhaust gasses are currently under investigation by the State Department of Public Health.

Public complaints about air pollution from motor vehicles are often directed at diesel trucks because of their noticeable black smoke and offensive exhaust odor. Such complaints are seldom made against

gasoline-powered vehicles. Yet, because of their relatively small numbers, diesels are not nearly as significant in the regional air pollution problem as are gasoline-powered cars and trucks. Diesels represent only about 0.3 percent of registered vehicles in California; and their emissions, therefore, are a small part of the total exhaust pollutant in the community.

The real benefit from the control of diesel exhaust will be the prevention of annoyance and irritation to the public. It will not affect photochemical smog significantly. Nevertheless, it is important to reduce or eliminate localized smoke and odor problems in the vicinity of diesel burning vehicles. The State Department of Public Health has recognized this by setting standards for smoke from diesels, and has announced that it will set standards for diesel odor when data become available to support them.

The Outlook for the Bay Area

No Easy Solutions

Although significant steps have already been taken by the Bay Area Air Pollution Control District and the State of California, air pollution persists and continues to increase. This fact, plus the growth that is predicted, makes it clear that there will be no easy answers to the Bay Area's air pollution problem. Growth brings with it the possibility that air pollution episodes will occur more frequently and increase in severity. The experience of Los Angeles emphasizes this as a probability. Thus there is a risk that Bay Area residents will have to look forward to living and working in communities where a large percentage of residents suffer from smog, where some kinds of plants cannot be grown, and where the view of the Bay and hills is frequently obscured by a gray-brown haze.

New Regulations Needed

The maintenance of satisfactory air quality in the Bay Area will require a greater effort than has yet been made, as well as new approaches and firm community action. The discharge of atmospheric wastes must be further curtailed in order to keep ahead of the area's future growth. Some of the sources for which new regulations will have to be considered include organic compounds from industry, backyard incineration, and agricultural burning. In October 1964, the district's advisory council reported to the board of directors that a regulation is necessary for organic emissions from all these sources. The council recommended that steps to regulate these emissions be taken concurrently with the state's program to place control systems on automobile exhausts, which begins with the 1966 model cars.

Oxides of nitrogen, produced in high temperature fuel combustion, must be given increased attention, and research in fuel combustion processes is essential to determine how the formation of the oxides can be minimized. To date, little effort has been made anywhere to control emissions of these substances.

Other Approaches

Because of topography and meteorological conditions, air resources of the Bay Area—as well as of other California metropolitan areas—are more limited than those of most populated places. *Measures that are effective in other parts of the country may not be adequate here. Even with the most efficient air pollution control equipment now available,*

it may not be possible to maintain air quality at satisfactory levels. In managing these limited resources, the Bay Area must consider new approaches, in addition to requiring the installation of control equipment. These include things such as zoning and future land use patterns, location of pollution sources, refuse disposal practices, and the entire system of transportation. Thus we must devise new policy-making machinery—or improve what we now have—in order to deal with a wide range of functions and activities that have a significant bearing on air pollution, although they do not normally come under "air pollution control programs" in the strict sense.

Automobile Emissions

Automobile emissions constitute the single most important air pollution problem confronting Californians. The Bay Area now has over 2 million motor vehicles; by 1980 there will be more than 3 million. California now has over 9 million vehicles, and it is estimated that 16 million will be registered in 1980.

Solutions to this complex problem must encompass several elements. Control devices or systems will be needed for existing automobiles and for those to be sold for a number of years to come. During this period, however, it is essential that research be pursued to develop engines whose emissions are low enough to do away with the need for special control devices. At the same time, the entire transportation system in the Bay Area should be planned with the objective of reducing the use of private cars as much as possible and of handling street and freeway traffic efficiently. To date, emphasis has been placed on the control of crankcase hydrocarbons and exhaust carbon monoxide and hydrocarbon. These efforts must be expanded to include all major sources of vehicle pollutants.

The Need to Look Ahead

Effective control programs require long-range planning and anticipation of future needs. Long lead times usually separate the initial recognition of a problem and the establishment of an effective solution. As early as 1948, for example, it was seen that air pollution might become a problem in the Bay Area. A regional control district was not formed until 1956. Regulation No. 2, covering most industrial sources, was not enacted until 1960. Now, in 1965, new state legislation increasing the district's current tax ceiling ($0.10 per $100.00 assessed valuation) is needed if the enforcement program for Regulation No. 2 is to become fully effective.[2]

[2] The 1965 session of the California Legislature is being requested to raise the tax ceiling.

Similarly, research findings on the role of the automobile in photochemical smog were reported in 1951. Laws establishing legal and administrative procedures for the control of exhaust pollutants from motor vehicles were passed in 1959 and 1960. As was noted above, the Automobile Manufacturers Association has announced that exhaust control systems for hydrocarbons and carbon monoxide will be installed on 1966 model automobiles, some 15 years after the research findings were reported. And even after 15 years, exhaust control devices will not be available for new foreign-made cars, large trucks and used vehicles. The importance of *anticipating* and reducing such long lead times is apparent if air pollution problems are to be solved before they become critical.

More Information Required

Air resource management will be effective only if sound data are available on which to base decisions. This means that strong technical programs will be required by agencies engaged in the control of air pollution. Information must be acquired on the sources and quantity of air pollutants, the contribution of various substances to air pollution, atmospheric concentrations, effects of contaminants, and costs of control or lack of control. Air quality standards supported by technical data are still needed for nearly all of the important pollutants and combinations of pollutants.

Because of its susceptibility to air pollution and its anticipated growth, the Bay Area should be in the forefront of efforts to learn more about effective methods of air resource management. We should also take a broader view of air pollution and try to gain a better understanding of the complex roles of pollutants and their effects; of the atmosphere's cleansing power and its limitations; and of possible modifications in climate that may be caused by long-term, large-scale and world-wide pollution of the atmosphere.

New Legal Procedures . . . and Activation of New Counties

As more and more sources are brought under control, it is doubtful that the *injunction* procedure—the legal device now available to the district—will be adequate to enforce regulations covering tens of thousands of sources. It may become necessary to subject violation of regulations to a *misdemeanor* charge—as is done in Los Angeles—in order to provide a more effective means of enforcement.

And before the control effort can be truly regional, Sonoma, Napa, and Solano counties must actively join the district.

Expenditures Must Be Made

The cost of cleaning up the air will be high. It is not unusual for a single large industry to spend several hundreds of thousands of dollars to control air pollution. The total cost of the motor vehicle emissions control program will be particularly high, primarily because of the large numbers of vehicles involved. Initial installation of crankcase control devices on the existing 2,000,000 automobiles in the Bay Area will probably cost over $20,000,000, and this does not include continuing expenditures for inspection, service and maintenance of the devices; and for devices on new cars to be sold in the future. Exhaust control devices will cost even more. These expenditures, and the broad application of control measures, clearly illustrate the importance of research to obtain the necessary information upon which to base future air pollution control decisions.

The technical problems of reducing or eliminating the discharge of contaminants can be solved. Proved control methods are now available for many sources of contamination in the Bay Area. And these existing control methods can be improved. Where present control methods are not available, satisfactory ones can be developed if it is deemed important to do so.

But implementation of technically feasible controls will not be easy because such measures impose hardships on many individuals and interests. Accordingly, some segments of industry and the public who are affected by controls will oppose them, or attempt to have them softened. The success or failure of air resource management in the Bay Area will depend largely on the strength, speed and effectiveness of support for the control efforts that are needed soon to cope with the smog problems that lie ahead. The outcome will depend on the balance which the region's residents and community leaders strike between the adversities of increasing smog and the costs of effective control.

IV

FRANK M. STEAD

MANAGING MAN'S ENVIRONMENT . . .

Managing Man's Environment in the San Francisco Bay Area

INSTITUTE OF GOVERNMENTAL STUDIES
University of California • Berkeley, California
DWIGHT WALDO, Director

Managing Man's Environment in the San Francisco Bay Area

BY

FRANK M. STEAD
Chief, Division of Environmental Sanitation
California State Department of Public Health

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Introduction

California and Californians have reached the end of an era that began a little over two hundred years ago. This is the era of man living in an environment as an animal lives in the environment, adapting to it but not appreciably changing it. There is reason to believe that the Indian aborigines of California had some feeling for the number of humans who could live in a "state of nature," as it were, subsisting off the natural fruits of the land with only the necessity to convert the natural products into clothing, shelter and implements.

When the white man reached numbers of a few hundred thousand in California, he realized that he must alter and intensify the natural producivity of the land. There appeared in succession the arts of cattle raising, crop culture, exploitation of the timber and mineral resources, and the development of energy from fossil fuels and water power. But the belief persisted that the land itself was so vast and the resources so unlimited that the environment outside of urban areas would never be appreciably changed, and that population increase merely imposed the requirement of more cultivation and development similar to what had already taken place. Since the total area actually *lived* on was far less than one percent of the total land area, how could the whole of the outdoors be affected?

In recent years the "typical" Californian has begun to realize that the mere presence and activities of a few million people are bringing about profound changes in this apparently unlimited natural environment, and that we are now entering the era of the man-modified environment. The only choice remaining is to decide whether the man-made environment of the future is to be a rapidly deteriorating one as a habitat for man, or whether through careful management and orderly planning the world around us can retain its timeless capacity to lift the spirit and give meaning to the mere act of living.

This dilemma has been faced before in the portions of the world associated with man's early development, but never before with the suddenness which attends today's compressed time scale of technological change. In no part of the country will the impact be as dramatic as in California and the San Francisco Bay Area.

The change caused by this sudden shift in the relationship of man to his environment is fundamental, calling for a reorientation of his whole approach to the social system. But nowhere is the revolution more pronounced than in the methods and institutions which have been developed to maintain man's health and physical well-being.

The historical concept of public health in the field of environmental sanitation is giving way to a newly developing concept of environmental health, a change which calls for new organizational patterns in government, new legal concepts, new scales of values and new relationships between government and private enterprise.

In the pages which follow an attempt will be made to analyze some of the elements of the problem and to suggest the nature and scope of these changes. The discussion must, of necessity, consider these factors on a statewide basis, but special consideration will be given to the problems and relationships in the San Francisco Bay Area. The time period under study will be the next two decades, since this will undoubtedly constitute the transition period between these two eras in California's history.

Historical Concept of Environmental Sanitation

The earliest concept of public health, as it related to the environment, preceded the discovery of the pathogenic agents of disease and was a true habitat concept. Malaria, for example, as the name indicates, was thought to be caused by exposure to nighttime air, with its high moisture content. Other diseases were thought to result from exposure to simple filth in the environment or to be caused by faulty diet. These beliefs, had they persisted, would have resulted in a more comprehensive concept of environmental sanitation than the one which developed following the discovery of germs as the causative agent of specific communicable diseases.

Hard on the work of Pasteur followed the identification of the biological agents causing the human diseases which decimated whole populations during the Middle Ages: plague, typhus fever, cholera, smallpox, tuberculosis, diphtheria, yellow fever, typhoid fever and malaria. These discoveries ushered in the "golden age" of public health in the western world, but for one hundred years left the stamp of a narrow perspective from which public health is just now beginning to emerge. This narrow view rested on a conviction that the one and only legitimate concern of public health was the control of *communicable* diseases.

Diseases transmitted by an *environmental* vector—such as food, water, or insects—were entrusted to the engineering and nonmedical sciences. The control effort was given the name "environmental sanitation," a title which still harks back to the original concern with filth as the cause of disease, even though cleanliness *per se* was no longer a prime objective.

In the following pages are briefly sketched the main characteristics of the environmental sanitation programs as they developed in this country during the first half of the Twentieth Century.

Air Sanitation

Air itself is not a causative agent of communicable disease, hence a concern with air was first focussed on its ability to be the vector, or medium of transmission, of germs exhaled by one person and inhaled by another. Early studies indicated that most germs of human disease could not survive long, free-floating in dry air. The risk was thus clearly confined to the limited range of travel of relatively large liquid droplets—greater than 50 microns—expelled from the mouth or nose,

involving distances of only a very few feet. Because this kind of risk is easily avoided by the mere exercise of personal caution, all concern with air, in large quantities, being a disease hazard subsided. The concern was not revived except in a few highly specialized situations.

Subsequently, little attention has been paid to the subject of air in the field of environmental sanitation, important as air is to the human being, as the sole source of oxygen for the blood, as a means of regulating body heat, as a receptacle for waste products of respiration and perspiration, and as a primary factor in the sense of comfort and well-being. Some attention has been paid, it is true, to the presence of toxic substances in the air of homes and work places (carbon monoxide, volatile solvents, and toxic metallic compounds) and to the abatement of nuisances resulting from dusts, smoke, and odors. But of the four basic components of the human environment—air, water, food, and shelter—air has received the least attention in environmental sanitation programs.

Water Sanitation

In contrast to air, water has preoccupied the attention of workers in environmental sanitation. This is understandable, due to the prevalence and severity of water-borne diseases unless preventive measures are taken. Fundamentally, the problem of water-borne disease control is simple. Virtually all of the water-borne infections are caused by the intestinal secretions of infected humans. The infection is acquired from water by drinking it. The problem of control, then, is to accomplish one of three things:

1. Keep human waste from reaching water;
2. Destroy the disease organisms in sewage by treatment before sewage effluent mingles with water; or
3. Destroy the disease organisms in water by treatment before the water is ingested.

All three of these principles are followed. When privies or septic tank systems are properly constructed and located, the soil prevents the disease organisms from traveling more than a few feet, although the water in the waste may eventually mingle with surface or ground water. When community sewage is discharged into water, it is treated to remove organic material and bacteria—incompletely, it is true. When water is taken from sources exposed to contamination, it is treated to remove turbidity and disinfected to destroy disease organisms completely. With one exception, these principles have served this country well for over fifty years. That exception is the case of treated sewage being discharged without complete destruction of disease organisms.

The water receiving this sewage may be perfectly safe for later domestic use *after* further treatment, but the stream into which the treated sewage is discharged may not be safe for swimming and other forms of close body-contact recreation involving some ingestion of water.

Other factors of concern have been included in the water sanitation field. These have to do with the presence of turbidity and organic matter, which make water unattractive to the eye or impart an objectionable taste and odor. Unduly hard water is not suitable for washing operations using soap as a cleansing agent, and an excessive mineral content may make the water unsuitable for the watering of plants or irrigation of crops, and (in some cases) unpotable or even unsafe for drinking.

The multi-purpose use of water, and the American practice of using a single water supply for all needs, has resulted in a broader scope of concern in the field of water sanitation than in other areas. The dominant concern, however, has consistently been to prevent water-borne disease.

Food Sanitation

Since food and water enter the body in the same manner, it is understandable that some of the water-borne diseases are also food-borne infections—the food being contaminated by the hands of an infected person as a result of poor personal hygiene. In addition, however, food is the vector for a much larger number of infections than water, because food is capable of serving as a medium of growth. Thus at a suitable temperature a few organisms can multiply many-fold in a short time. Some of these organisms (e.g., *Cl. botulinum* and some strains of staphylococcus) cause no infection by themselves, but when multiplying in food they produce toxins. Others, such as salmonella, produce true infections when ingested. Food sanitation, therefore, is an important link in the chain of defense against the transmission of disease by the agency of an environmental factor.

Because of the day-by-day frequency with which we prepare food, and the exposure it gets to unexpected contamination during storage, preparation, and handling, it is not surprising that food can accidentally become poisoned with a wide variety of toxic materials commonly used in commerce and homes. Consequently, food sanitation programs must also include efforts to minimize this risk.

Shelter Sanitation

Of the four major components of man's environment, one would suppose that a concern with *shelter* would loom largest. Consider man in a state of nature, at the mercy of the elements and endowed with almost

no natural protection against any of the predators, whether they be venomous snakes, stinging and biting insects, or carnivorous beasts. The concept of shelter includes protection against all such natural hazards, together with all those man-made risks such as fire, electric shock, and collapse of buildings, as well as the provision of an indoor artificial environment suited to his comfort and efficiency.

It is strange, but true, that programs of environmental sanitation have given relatively little attention to this most important field, leaving it to the architect, the structural and electrical engineer, and the manufacturers of heating, ventilating, air conditioning, and illuminating equipment to set the standards and guide the pattern of development. When one searches for the reason, it again appears that the lack of an obvious and demonstrable relationship between communicable disease and shelter has ruled the latter almost "off limits" for those engaged in environmental sanitation, except for a few peripheral activities, such as controlling rodents, flies and mosquitoes, or regulating sewage disposal, which can clearly be tied into human disease prevention.

* * *

In the foregoing brief synopsis of the historical concept of environmental sanitation, we see that a preoccupation with the single concern of disease control has always focussed attention on environmental resources or elements, such as air, water, food and shelter, at the point of immediate human contact or consumption. This has resulted in part because the step necessary to prevent the spread of disease can frequently best be taken at the point of consumption (i.e., disinfection of a water supply, or cooking of food). In part, however, it has resulted from the fact that with a small and scattered population, such as existed in California before 1920, man's adverse impact on the environment by the discharge of contaminating waste products had very limited and localized effects. A community, furthermore, could completely escape the effects of localized contamination of water by importing a virgin supply from a distant point, as was done by San Francisco and the East Bay cities.

The era of environmental sanitation, therefore, has been an era of every family or community for itself.

The Emerging Concept of Environmental Health

Increasingly, during the past decade, it has become apparent that the narrow confines of communicable disease control concepts and practices fall far short of meeting the problems of human health and welfare as related to the environment. The residents of the Los Angeles metropolitan area developed a deep concern bordering on frustration and despair as the air around them steadily worsened. Their concern was not relieved when they were told that air pollution had not been shown to cause disease or morbidity.

The people of the San Francisco Bay Area were chagrined by the jibes of World's Fair visitors in 1939 about the stench from the mud flats. Moreover they were not satisfied to be told that no one was swimming in the water, and that there was no evidence that this massive cesspool presented a real threat of disease, that—on the contrary—it contained its own built-in guarantee against people exposing themselves by close contact.

These and many other events furnished ample proof that whoever undertook to serve the public's interest in the field of environmental control must recognize the spectrum of human concern with the environment—a spectrum ranging all the way from concern for simple survival to a desire for conditions commensurate with full comfort and maximum enjoyment of life. Between these two extremes must be recognized not only threats of acute illness by either disease or poisoning, but the much more subtle effects of chronic impairment as a result of long-time exposures, and factors which interfere not only with man's performance and well-being, but also with the well-being of the plant and animal world upon which he depends.

In short, it has become evident that he who undertakes to regulate man's environment for his physiological welfare must realize that this involves an understanding and management of the entire environmental system. The problem, in fact, is the ecology of man.

The Air Resource

Air pollution develops in three stages. Community concern always begins with complaints of isolated point-sources. Residents downwind from a garbage dump, a sewage disposal outlet, a rock crusher, a sawdust burner, or an industrial plant, complain of odors, dust, or smoke. The source is easily identified and the affected population is small and

localized. The remedy is the common law remedy, which is part of our Anglo-Saxon heritage, namely, abatement of a nuisance.

The classic definition of a nuisance has not changed appreciably in five hundred years. A nuisance is anything which is dangerous to health or which interferes with the comfortable enjoyment of life and property. It is extremely interesting to note that the concept of "comfortable enjoyment" is a holdover from the time *before* intensive preoccupation with disease. An important aspect of the definition is that, while health authorities may serve as expert witnesses to the "hazard to health," only the people who are affected can testify to the "interference with comfort and enjoyment." Failure to recognize this point has been responsible for the poor record of air pollution control in California communities during the point-source phase of air pollution.

The second stage of air pollution occurs when there are so many point-sources that the products merge and it is no longer possible to attribute the resulting unsatisfactory condition at a given place to a single known source. The causes may be qualitatively the same: odor, dust, smoke, and irritating gases—but they are mingled together. At a given point the odor may come from the discharge of untreated sewage or volatilizing of organic vapors from a hundred different sources; the smoke may come from dozens of large industrial stacks, combined with hundreds of smaller fuel-burning installations, thousands of vehicles and tens of thousands of household burning activities; and the irritating gases from hundreds of combustion and chemical operations. At this stage, the entire air mass in the community has become impaired by the activities of virtually the entire industrial sector, many municipalities, and a large number of private individuals and householders. It is a question of too many tons of pollutants emitted per square mile of occupied area.

At this point the use of the historic nuisance abatement procedure becomes impossible because of the large number of parties involved as offenders, and it is necessary to apply the principle of regulation by government. In passing, it should be noted that the community now faces two dilemmas: it has no set of objective standards for air quality which have been shown to reflect the people's expectations, and it is not sure what agency should be assigned the task of regulation.

The third stage of air pollution—which was first dramatically demonstrated in Southern California—is the stage where chemical substances, relatively innocuous in themselves at the concentrations normally encountered, react with each other in the air to produce new compounds. These new compounds are extremely irritating, if not indeed dangerous to human beings, are lethal to some forms of plant life, and are

capable of destroying the transparency of the air. This is what has come to be called photochemical smog. The two principal raw materials are hydrocarbons and oxides of nitrogen. The energy for the reaction comes from sunlight. Here indeed is a unique dilemma. California is dependent upon a petroleum economy. Only petroleum fuels are used, whether in gas or liquid form, and petroleum is entirely hydrocarbon. These fuels are used in industries, public and commercial buildings, individual households and all motor vehicles. In addition, petroleum furnishes the solvents for most paints, resins, insecticides, and other formulations which in normal use release *all* of the solvent to the air.

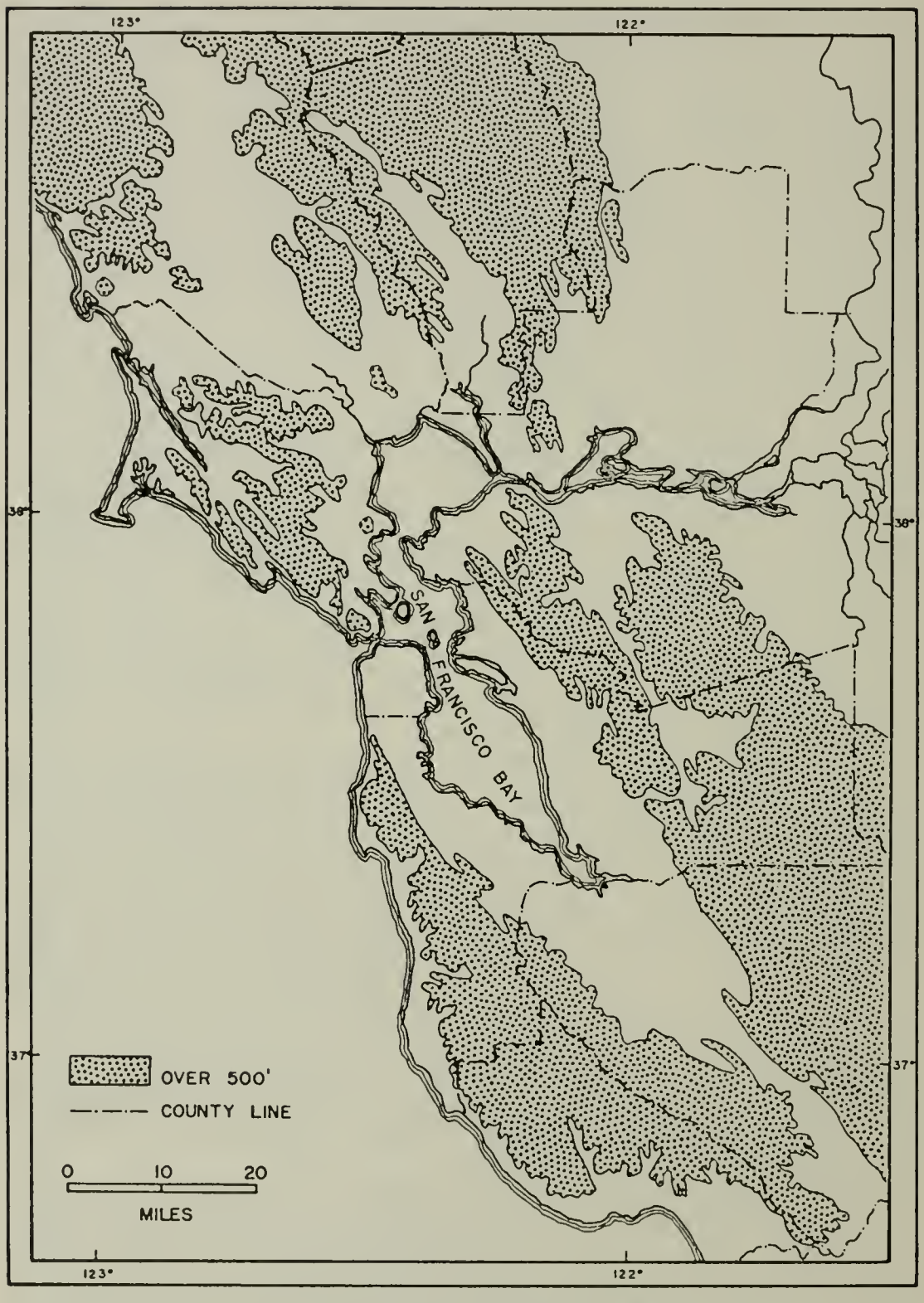
The air itself is 79 percent nitrogen. Some of this nitrogen is burned to form oxides of nitrogen in every combustion involving flame.

Thus California has an unfailing and almost unlimited supply of hydrocarbons and oxides of nitrogen, a supply that grows at a faster rate than the population itself. These contaminants, along with the phenomenal quantities of solar radiation received, produce and will continue to produce huge quantities of the oxidants that result from the reaction of hydrocarbon with nitrogen dioxide. This reaction sometimes takes place in less than two hours in bright sunlight. Is the ventilation of California air basins adequate to handle this loading of air contaminant? That is the critical question.

Here we face the heart of the California air pollution problem. California, like the western shores of all major continents, is subject to meteorological conditions which impose a ceiling on the vertical flow and escape of air that is polluted and warmed by urban activities. This ceiling may be as low as 1000 feet on as many as 100 days a year. Often it drops even lower. If an area forms a basin—as the San Francisco Bay Area does—when the ceiling drops below the rim of the basin the metropolitan area is, in effect, enclosed in a gigantic circus tent. On these days the air resource becomes an extremely limited thing, and air pollution becomes a three-dimensional problem. The critical concentration of oxidant (0.25 parts per million) is achieved with as little as 25,000 cu. ft. of hydrocarbon per square mile.

Smog was first noticeable in Los Angeles in 1930, became moderate in 1940, and was serious by 1950. Extremely intensive controls started in 1945 are all that make the area habitable today. The state has established standards for motor vehicle exhaust which, when applied, will "roll back time" possibly fifteen years, but except for this one-time gain will not stop the upward trend of air pollution.

The Bay Area may be thought of as, in effect, 20 years behind Los Angeles but travelling the same path of deteriorating air quality. If the San Francisco Bay Area does not quickly apply presently achievable



Map 1. The San Francisco Air Basin

controls to stationary sources, and if a high degree of motor vehicle control is not implemented in the near future, the region can look forward to a time schedule about as follows: in 1970, serious pollution, and by 1980, levels of air pollution which destroy scenic values and cause severe discomfort at least 75 days per year. The Bay Area air pollution problem differs from that of the Los Angeles area in several important respects. The Bay Area is subject to fogs, and therefore must give especial attention to the sulfur gases—especially SO_2 and SO_3. Sulfur dioxide oxidizes to SO_3, and the latter combines with water to form droplets of sulfuric acid, which can cause serious damage to the respiratory system. Secondly, the topography of the Bay Area, together with the scenic value of the hillside homesites, makes simple enjoyment of the view in the immediate foreground a daily experience of which the residents are deeply conscious. Destruction of this amenity will not be tolerated for long—hence hydrocarbon vapors and oxides of nitrogen in the Bay Area atmosphere must be kept at remarkably low levels to satisfy the people. Finally, the air pollution control district in this area was established to *prevent* air pollution from developing, not to cure it after it had become serious. Thus the foregoing forecast calls for the most rigorous control efforts if a mass outcry of indignation by the populace is to be averted.

Several choices are available to halt the upward course of air pollution and the downward trend in air quality. In the order of their effectiveness they are:

1. Shift to a new power source for motor vehicles. The alternatives presently considered technologically feasible are the fuel cell and the electric storage battery.

2. Enclose industrial chemical processes. It is technologically feasible to design industrial chemical plants, such as oil refineries, on a "closed" basis with no discharge to the atmosphere.

3. Abandon petroleum fuels for stationary power generating. Nuclear power is the principal technologically feasible alternative. Although some expansion of hydroelectric power is still possible, it will not represent a net gain, since energy will be required to transport the water whose impoundment produces the power.

The cost of these changes lies chiefly in the "changeover" itself, rather than in the costs of the new operating methods. These changeover costs would run into billions of dollars.

The Water Resource

In November, 1960, the electorate of the state was asked to vote on the issue of financing the California Water Plan with initial general

obligation bonds in the amount of one and three-quarters billion dollars. In effect, this referendum really meant that the state had reached the end of the time when water resource problems could be solved a community at a time. Far more fundamentally, however, this election marked the end of an era when Californians used a system of natural waterways, and the beginning of a conversion of the entire water resource of the state into a gigantic man-made water system. The effects of this type of change will be profound, and will alter the entire rationale of the use of water. Until now, the waters of the state have flowed in river systems which passed through valleys and discharged to the ocean. Communities, industries and agricultural areas took water from these rivers, used it, and discharged used water back into the rivers, with and without treatment.

Under the new system there will be no rivers running to the ocean. Instead, the water conduits—whether they be natural stream channels, lined canals, or closed aqueducts—will be, in reality, water supply lines which terminate with the final user. Under this arrangement it will no longer be possible to discharge waste water with a high burden of organic and inorganic chemical loading back into the water supply lines as a general pattern. Instead, the used water—be it sewage, liquid industrial wastes or return irrigation drainage—must be reclaimed or kept separate from the new water supply. If kept separate it must be used in such a way as not to impair the ground water—which will be the major storage feature of the new water system. Otherwise used water must be wasted by evaporation or conveyance to the ocean. It is imperative to understand that a fundamental transformation is taking place.

The basic elements and long-range implications of this transformation must be considered on a statewide basis. Some of the implications include the following: The present concept of disposal of sewage and industrial wastes by dilution into fresh water streams must give way to concepts of reclamation, that is, conversion of waste water back to "water" which can be put to the same uses as "normal" water. In the long run, this accomplishes great economies for two reasons. First, the added cost of reclamation, beyond the cost of types of treatment now required, is offset by the fact that one recovers water, which replaces part of his demand. Second, the cost of moving water is greatly reduced, and in the last analysis, transportation will be a major part of the total cost of water.

Although the big issues must be decided on a statewide basis, the effects will be felt in local regions. Nowhere will the changes be more important or dramatic than in the San Francisco Bay Area. This might not seem to be the case on first thought, because the communities of the

Bay Area have imported their municipal water supplies from distant mountain sources for decades (the Hetch Hetchy and the East Bay Municipal Utility District aqueducts), and discharged their liquid wastes into separate receiving waters (San Francisco Bay and the Pacific Ocean). The facts are, however, that above Carquinez Straits, Suisun Bay constitutes a second fresh water system which, in effect, has been a river flowing through the area. Industries, in particular, have used Suisun Bay as a source of fresh water for processing, cooling, and as a resource for dilution of waste water.

Implementation of the California Water Plan will effectually terminate this fresh water flow from the Sacramento and San Joaquin river systems and transform Suisun Bay into a finger of San Francisco Bay with relatively little flow-through, changing the water from fresh (or brackish) to salt. Profound changes will occur in the northern portions of the Bay as a habitat for fish life, affecting the local as well as the anadromous species. As the Bay Area continues to develop, its fresh water needs will be supplied in part by aqueducts from the Delta pool, and at this point the communities have the opportunity to decide whether to continue the historic pattern of a *single* water standard or to go to a *multiple* standard. The time may well be near when it becomes uneconomic to supply water of "drinking-water" quality for use by agriculture and industry, as well as for use by householders in watering their yards, washing, and transporting sewage.

It may well be that recreational lakes for fishing and boating are best produced by impounding reclaimed water, thus freeing domestic water reservoirs from the need to maintain the high organic loadings necessary to support good fisheries.

These changes would, it is true, require the development of suitable safeguards to meet the classic public health concern of disease control, but this presents no really serious obstacle if public education and understanding accompany the changes.

One begins to see, in a case such as the California Water Plan, that the man-made changes in the environment need not be destructive; if properly conceived, they can be the means of "improving on nature." The California Water Plan, however, furnishes a dramatic illustration of the fact that when such broad modifications are made, not all people benefit equally, and some are damaged.

The Food Resource

The historic concern with food contamination at the time of preparation for consumption will always continue, but in the past decade there has been a dramatic shift of interest to the areas of food production. The

occurrence of radioactive fallout and the widespread use of insecticides and other agricultural chemicals that cannot be eliminated in processing, have brought public understanding of the fact that contamination can occur in the field.

The time-honored public health measure of prohibiting contamination is not applicable in this case. The chemical residues do not result from mistakes or carelessness. Instead, chemicals are the tool that agriculture has used to multiply the productivity of the land and improve the quality of food crops.

The prime agricultural land in California is limited, amounting to approximately 15 million acres out of the 105 million acres of total land in the state. Maintenance and expansion of the intensified levels of production of food and fibre, and maintenance and improvement in the high quality of the produce grown, call for carefully designed use of tens of thousands of tons of chemicals. These include soil amendments, fertilizers, growth regulators and defoliants (to facilitate mechanical harvesting) and insecticides. The necessary use of insecticides amounts to many thousands of tons per year in California. Chemicals are applied to many crops by many people. Keeping track of the chemical residues on the food itself calls for an extensive program of systematic monitoring, as the crops come to maturity and go to the processing plants or to fresh produce markets. It is even more important to take account of the total chemical burden on the agricultural basins in which the crops are grown.

The fifteen million acres of agricultural land should be thought of as a chemical reaction platform on which intensified biochemical reactions are taking place. The raw materials and environment for these reactions must be kept at an optimum steady state for the maximum quantity and quality of yield.

We are in a period of technological transition in the development of food. For example, butter has been to a large extent replaced with margarine. Environmentally this is a step forward, assuming that the two products are equally desirable in terms of nutrition and enjoyment. This is because, in the case of margarine, the food chain has been shortened. The food has been produced from a plant grown on the soil instead of from an animal grazing on a plant. Whenever the food chain can be shortened by one link in this manner, production per acre of land is increased several-fold. The technology of food processing is rapidly expanding our ability to take plant materials in the form of oils, proteins, sugars, and starches, and to transform them into food products with all the desirable characteristics of those produced from animals. With increased versatility along these lines, the best use of

agricultural land for food production becomes that which results in the highest quality of end product.

In this connection, it is interesting to note that over ten times as much food in the form of fat and protein can be produced by growing algae in an acre of water, as can be produced by grazing animals on an acre of alfalfa or other forage.

An equally significant technological explosion is taking place in the field of food processing. Through the use of chemicals in the manufacturing of such foods as bread, or the processing of fruits, vegetables, meats, poultry, jams and dressings, almost any characteristic of taste, texture, color, flavor and keeping qualities can be imparted. New methods of dehydrating, sterilizing and freezing are eliminating the old limitations on the shelf-life of perishable foods, and making virtually all foods available in all parts of the country and in all seasons. New concepts of premixing, precooking, merchandizing and packaging will soon bring to the consumer ready-to-eat meals which involve no more extensive preparation in the home than adding water or heating, and these complete menu items will be vended in a manner to make today's market obsolete. Technologically, therefore, it is possible to increase greatly the production of foods and their availability at moderate cost, and virtually to eliminate the household work of food preparation, which once kept one person in each family fully occupied.

The most exciting development of all, and one which lies just ahead, is the improvement on natural foods—the conception and development of food products that do not occur in nature. Technologically this is entirely possible; the only limitation is man's imagination.

The petroleum industry has created many new and marvelous commodities by synthesis of simple hydrocarbons: commodities ranging from plastics and resins to new fabrics, insecticides and detergents.

In the same manner, agriculture has the power to take the vast quantity of plant material that now goes to waste, reduce it to simple compounds by processes akin to those utilized in sewage treatment, and synthesize from these materials food commodities never before seen. Fundamentally this is exactly what occurred when bread, beer, and cheese were invented.

The Shelter Resource (The Living Place)

The historical concept of shelter is that of a dwelling, or house, which protected man from the elements. Around the concept of protection has developed the idea of a dwelling as a place where one lives. This broader view encompasses a consideration of all of the functions of living and the devices and amenities to make life convenient and enjoyable. Mat-

ters of layout, design, architecture, grounds and gardens join with equipment, appliances and devices for amusement to make up the image of "the place where we live."

In applying the principles of environmental health to the field of shelter or living place, one may consider the metropolitan area as a whole. Visualize the San Francisco Bay Area as such a "dwelling." It has its "bedrooms," "kitchens," "dining rooms," " recreation rooms," and "shops." It has its problems of convenience of layout to facilitate moving from one part to another without "traffic jams," and it has its "architecture" and "view windows."

Let's start with the latter. The Bay Area is three-dimensional. Its opposing slopes face each other as if through windows, and its hills make it multi-storied. The Bay itself is a courtyard or patio around which the rooms are grouped. Through the "view windows" the scene is colorful and ever-changing. The "air-conditioning system" is unique, and facilities for amusement are almost unlimited. The area conveys a sense of space and grounds—a feeling of elbow room. Contact with the outdoors and the landscape is completely satisfying.

These features have given residents a sense of identity with and personal ownership of San Francisco Bay to an almost unique degree. Those who live on view lots consider the panoramic vista their personal property. Time was when they felt this same kinship with the water itself. In the days of the ferries, Bay residents were a maritime people. When the bridges were built the people were separated from the water by less than two hundred feet, but they no longer felt its waves or smelled its spray, and the demands of bridge driving deprived them of a chance to watch its changing moods.

An earlier generation living in the Bay Area before the turn of the century enjoyed another unique resource that has all but disappeared. This was the seemingly unlimited number of wild fowl, sea otters, shrimp, clams, oysters, fish of every kind and even whale that abounded in the area.

The population increase which followed the disappearance of the ferries resulted first in massive pollution of the waters of the Bay, particularly along the Berkeley, Emeryville, and Oakland shoreline, and the Oakland Estuary. Next it showed itself in the form of traffic congestion. The water pollution is yielding to control efforts, but the traffic becomes worse in spite of heroic efforts to open up more channels of flow. The traffic problem is like the air pollution problem: when a certain critical point is reached, the total loading overtaxes available space.

In San Francisco, as in most American cities, over half of the total area or space is devoted to the motor vehicle, being occupied with

streets, garages, parking lots, freeways and distribution structures. This invaluable open space, which should be fulfilling people's need for outdoor room, is dedicated to a system of transportation which is not serving well and which is rapidly becoming worse. Space is the one natural resource which cannot be moved or imported. Therefore it is the ultimate limiting factor in population concentration. If traffic is to be two-dimensional (that is, on the surface) San Francisco has now reached its limit with a system based on *individual* private vehicles.

In yet another sense the Bay Area is facing a space problem. Over half of San Francisco Bay is shallowly submerged land. The cities in the area are all engaged in disposing of garbage and refuse by landfill methods, and are rapidly filling in tidal land. Private landowners are filling by dredging. The Bay could shrink to a fraction of its present size in twenty years if current trends continue. If this were to occur, the area would lose its unique charm and appeal as a place to live, and its residents would lose the sense of open space they now experience daily.

* * *

In the foregoing sections on the emerging concept of environmental health, we have been dealing with the environmental system as a whole. We have seen that the entire system in California is being rapidly transformed by the collective actions of sixteen million people, and that many of these massive changes are irreversible. Obviously, the rate of change will accelerate with growing population. Actually, it can be shown that environmental changes occur at a much faster rate than population growth. The reason for this is based on simple geometry. If an activity of man has a zone of influence of, say, one quarter mile, and if such activities are separated from each other by a half mile or more, then each activity is surrounded by a zone of undisturbed environment. The activities do not affect each other and the total environmental impact is in direct proportion to the number of such activities. If, on the other hand, these activities are located close together, then they may interact with each other to increase the resulting intensity of environmental impact above the critical level. They may, in fact, produce new effects qualitatively different from those of the individual activities whose zones of influence do not merge. This principle is equally applicable whether the environmental resource being affected is air, water, or land.

If the California heritage of a well-nigh ideal habitat for man is to be preserved, a new sense of values must be established as a basis for decision-making. Collective planning must replace single-interest planning. These questions will be discussed in the concluding sections of this paper.

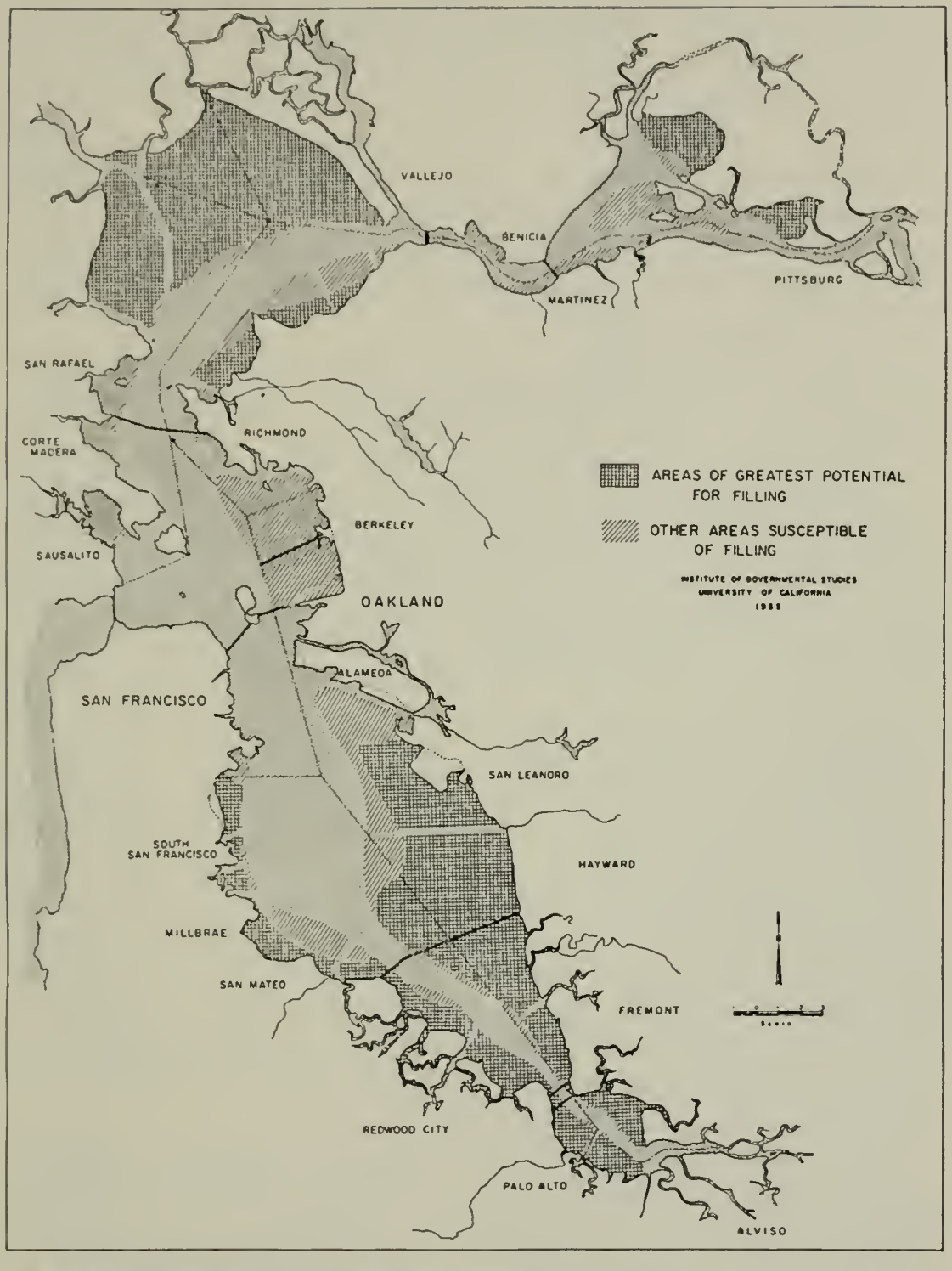
Need for a New Value Scale of Environmental Quality

In the foregoing section, it was shown that the major decisions to be made with respect to environmental health have to do with the quality to be preserved in the environmental resources: air, water, food, land, and living environment. These quality decisions cannot be made in a vacuum. Maintenance of quality is only achieved by foregoing the immediate savings (or earnings) that accrue to some if the environment is exploited. For example, well over a billion dollars has been spent by California communities for sewage treatment to maintain the present quality of the waters of the state. Hundreds of millions of dollars have been spent by industry to minimize air pollution, and probably half a billion dollars will be spent by car owners in the next few years to install exhaust control devices.

It would be ideal if the decision on expenditures to preserve the quality of the environment could be left to each individual, or property owner, or governmental unit, under the free market principle. Unfortunately, the free market principle does not apply because the costs of environmental quality maintenance are not distributed to the same parties as the benefits. If City A discharges inadequately treated sewage to a river, a whole complex set of penalties is set in motion. City A's water supply is not affected, but City B downstream will have to provide extensive treatment and still have an inferior quality of water, or may be driven to seek a new source entirely.

Furthermore, many people—some from City A, some from City B, and some from distant points—are deprived of opportunities for water recreation. Persons living along the stream as well as those traveling along the banks are deprived of their enjoyment of the countryside. Fish may be killed and salmon runs prevented. Farmers may no longer be able to irrigate food crops with water from the stream. The network of penalties from this single discharge of waste is extremely complex and extensive. The situation becomes infinitely more complicated when, instead of a single discharge, the total loading on the environment of solid, liquid and gaseous wastes is taken into account.

To the environmental impairment caused by air and water pollution must be added the loss of productive land, the spoiling of open countryside, and the destruction of those characteristics of the urban environment which provide opportunities for recreation and make for the comfortable enjoyment of living.



MAP 2. CONSERVATION VERSUS LAND DEVELOPMENT: THE COMING STRUGGLE FOR THE BAY

Obviously, no effective means of legal redress is available to injured parties under such a complex system of cause and effect. Consequently the problem has, of necessity, been partially dealt with by government through its powers of regulation. Air pollution and water pollution are regulated in California, but there is still no realistic regulation of land use in the state. Decisions on land use are made by the landowner, based largely on the incentive of profit to himself. It is obvious, therefore, that one of the most immediate and urgent needs is the development of some mechanism of land use control which can be geared more closely to the public interest.

But even when legal machinery is available for regulating actions which impair the environment, a major problem remains. What criteria or scale of values is to be used as the basis of regulation?

This question did not arise in the era of environmental sanitation when control of disease was the prime concern. Then, as now, when the public health was threatened, economic considerations were set aside by common consent and public health agencies were expected to take any steps necessary to remove the danger. For this purpose they were vested with virtually unlimited use of the police power.

But in the environmental impairments we have been considering, we are dealing with such things as freedom from nuisance and the maintenance of conditions which preserve opportunities for recreation and enjoyment of living. No one has sanctioned the setting aside of economic considerations here. What is it worth to preserve these characteristics of the environment?

Several attempts have been made to measure the value of recreation to people. Most of them consist of determining the amount of money which people spend on recreational trips. By this means, for example, it has been estimated that fishing recreation in the San Francisco Bay Area costs twenty-five million dollars per year. But this immediate out-of-pocket expenditure on recreation does not really measure the *worth* of the recreation to the people benefited.

A more rational and fundamental approach is suggested herewith. Assume that on the average a person devotes one day per week to planned recreation away from home. He looks forward to this day all during the week, and it becomes in a sense the most valuable day of the week to him. Assume, therefore, that it is worth a day's wages, say $25. Project this figure on the basis of a worker's lifetime earning power. In the forty years of his effective career the average man will work 10,000 days, and during this time he will have had 2,000 such recreation days. In retrospect would he not consider that these recreation days constituted as important a part of his investment in living as one fifth of his working time? I think so.

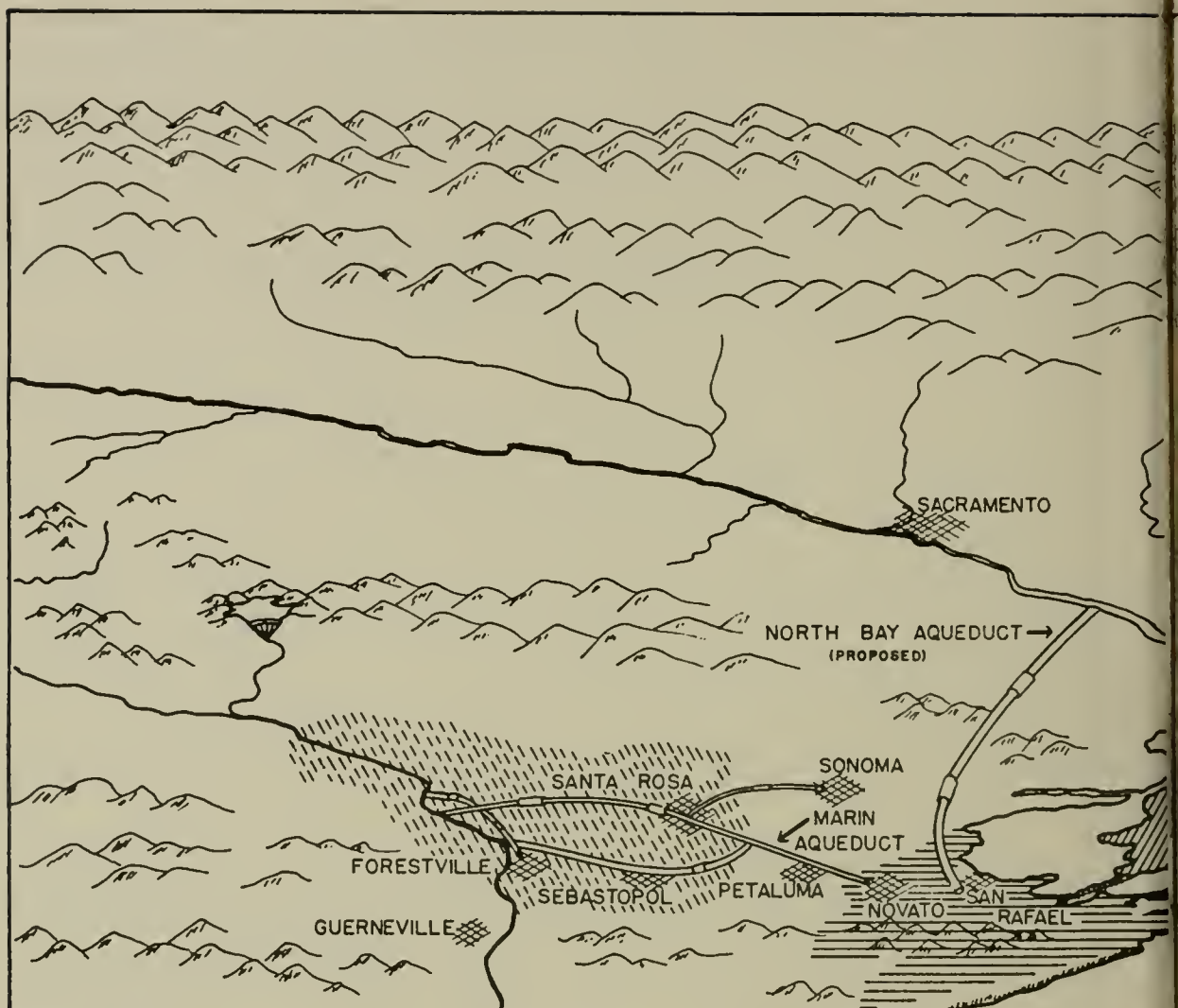
An indication that this value is not out of line is being furnished by the fact that, increasingly, when skilled hourly workers are confronted with the choice, they choose a reduced work-week in preference to a five-day work-week. In effect, they will trade a work day for a recreation day.

Assuming that this value of $25 for a recreation day is in the right order of magnitude—and this figure has no relation to the amount of money *spent* on that day—outdoor recreation is worth one and one quarter billion dollars per year to the San Francisco Bay Area's one million workers. The worth of the recreational resources of the Bay Area, on the other hand, would be arrived at by computing (at saturation use) the number of recreation day opportunities existing now or in the future on an annual basis and multiplying this figure by $25.

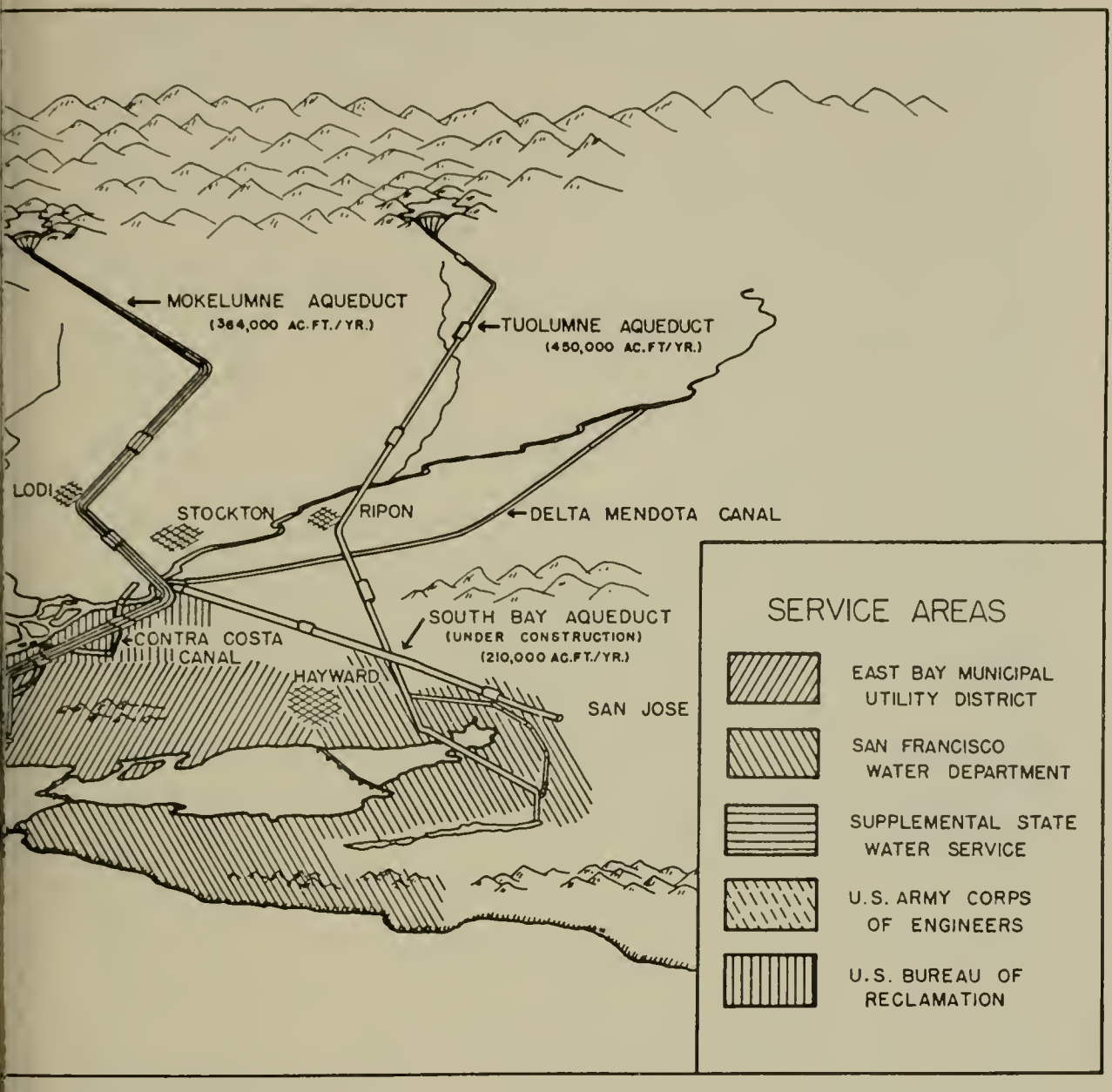
San Francisco Bay and its shoreline could easily be developed to furnish recreation opportunity for one million persons per day over at least eight months of the year. This would mean an annual worth of recreation to those persons engaging in it of five billion dollars per year. Application of this principle would furnish, for the first time, order-of-magnitude dollar values to be balanced against the cost of measures to maintain optimum environmental conditions for recreation in the Bay Area.

A similar, but somewhat different approach may be taken to determine the value of the environmental setting of the Bay Area simply as a place to live. Past efforts to estimate this value have been directed to measurement of property values in various localities, with particular reference to such things as view lots. This approach falls as far short of estimating true worth as the method referred to earlier. What is needed is an entirely new way of justifying the expenditure of large sums of money to maintain optimum environmental conditions in man's urban habitat. It is customary to refer to these values as amenities, with the strong implication that they are nice to have but can be dispensed with if they interfere with important things like economics. To put these values in proper perspective, consider that a person lives in three worlds, which may be described as the world of himself, his physical environment and his social environment. A deficiency in any of these worlds can be adjusted to, but leaves his life incomplete. Each of them, therefore, is fundamental to a completely successful life.

The physical environment is a collective inheritance and not the result of man's effort. All of the investments made by individuals or society to build homes, roads, or water systems are merely improvements on the inheritance. Commerce and industry are operating costs. The total value of the man-made improvements and the total cost of operation bear a relationship to the value of the environmental system similar



Map 3. Water For The Ba



EA: THE RACE AGAINST TIME

Adapted from P. H. McGauhey and H. Erlich, "Economic Evaluation of Water; Part II: Achieving Comprehensive Development," (A report in preparation, Sanitary Engineering Research Laboratory, University of California, Berkeley).

to that which the maintenance and operating costs of a private household bear to the total value of the home itself. This analogy furnishes an opportunity to apply familiar concepts of economics and financing to the environmental system. The total assessed valuation of the real property in the nine counties of the Bay Area—analagous to improvements—is seven and one half billion dollars. This means an estimated real value of thirty billion dollars. The total (environmental) value should be at least one order of magnitude greater than the "improvements" and, therefore, in the order of 300 billion dollars. Annual maintenance costs of one percent of the "real" value of a property are not considered excessive. Operating costs customarily run around five percent. On these bases, it would be reasonable to expend three billion dollars per year to maintain the environment and fifteen billion dollars per year to "operate" it.

In other words, the value of the natural environment in the San Francisco Bay Area is such that application to it of current "homeowner" concepts would justify expenditures of up to three billion dollars per year to develop and preserve its esthetic qualities, assuming the area has a business and industrial gross annual volume of fifteen billion dollars.

Substitution of such concepts for emotional statements could furnish, for the first time, a rational basis for balancing environmental values against the cost of their preservation.

Need for a New System of Decision Making

As was pointed out earlier, under a system of environmental sanitation, departments of public health are entrusted with the job of deciding on measures to prevent the occurrence of communicable disease, and vested with the authority to enforce their decisions. This is logical, because only a health department has the expert knowledge to make such decisions, and there is no question of taking economic factors into account.

The making of environmental decisions where disease is not involved is an entirely different matter. In this case, no one grants to a single agency the expert status. Furthermore, the decisions now involve the business and programs of dozens of agencies and hundreds of parties. The decision must be presented for general judgment on its merits and accepted by those who must act to carry it out. It is not even unanimously agreed that the decision is an executive governmental one. In the case of the California Water Plan, for example, the Legislature made the decision, subject to confirmation by the electorate.

In California state government at least a dozen departments are involved in environmental programs. How then can the planning decisions be made to determine the course of environmental affairs? Local governments alone cannot do this job. Not only state government, but some form of regional government must play a leading part, and some way must be found to develop a partnership among all three of these levels of government and private enterprise.

No significant progress can be made in sound and orderly management of the environment with the present fractionation of the decision-making processes, the lack of machinery for coordinating activities of the state agencies around the common denominator of environmental health, and the presence of a communication barrier between government and private enterprise.

And yet, how can such a multi-party decision-making process be formulated? Two of the most deeply cherished American traditions have in large part been responsible for past failures to make sound long-range environmental decisions. They are, first, the tradition of a free private enterprise system in which decisions are dominated by a concern for financial profit in a free competitive market, with a minimum of interference by governmental controls. The second influence is the tradition of home rule, visualized as government-by-one's-neighbors, and characterized by fear and distrust of higher levels of government.

No new decision-making machinery for environmental planning which runs counter to these two traditions has much chance of acceptance. The only solution, I believe, is for private enterprise, local government, and state government to identify and recognize common goals. This can only be done by looking far enough ahead to escape the strictures of current practices, politics, laws, and personnel.

No easy or pat answer is likely to be found ready-made. It should be helpful, however, to suggest some steps that might constitute a beginning:

1. State departments must take the initiative to assemble in an orderly way the basic elements of the environmental health picture;

2. Local governments in the region must establish a mechanism for joint review of these basic environmental factors;

3. State government, local government, and private enterprise must develop a neutral forum where, in an atmosphere free from coercion or threat, the basic environmental policy decisions can be freely discussed.

In California, and especially in the Bay Area, beginnings are being made on all three of these fronts. The State Office of Planning is, for the first time, actively calling on those state agencies involved in the environmental health field to start collecting fundamental environmental data, as a basis for common, long-range planning.

The Association of Bay Area Governments is addressing itself to problems of water pollution and refuse disposal in the Bay Area, and proposes to initiate a program of comprehensive regional planning in the near future.

In January of 1964, 500 leaders, drawn proportionately from government, science, and private enterprise, will meet for the first joint discussion of current environmental trends and their implications for life in California in the 1980's (see Appendix).

These are small beginnings, but they may develop into the first real machinery for effective decision-making in the environmental health field.

Meanwhile, time and change rush on apace in the San Francisco Bay Area. The changes now occurring—like the passage of time itself—may well prove irreversible!

Appendix

MAN IN CALIFORNIA—1980's: A DIGEST

A digest of presentations made before a selected group of fifty people on January 15, 1963. This meeting was held in preparation for a statewide conference on "MAN IN CALIFORNIA—1980's," to be held January 27–28, 1964.

Conference Steering Committee:

Frank M. Stead, *Chairman*
Daniel G. Aldrich, Jr.
L. M. K. Boelter
W. J. O'Connell
Elliot Schrier
Charles E. Smith
Samuel E. Wood
Paul W. Yinger

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Concept of the Conference

Frank M. Stead

Three concepts have prompted the Steering Committee to undertake a "CONFERENCE ON MAN IN CALIFORNIA—1980's"—in January, 1964.

1. First, there is a need to establish a free forum where leaders in science, government and private enterprise can deliberate and tackle together the problems of this growing state, in a strictly neutral atmosphere.

2. An interplay exists today, and will increase in the future, between the three basic environmental elements: air, water, and land. In the early days of California, man's way of life had but small localized zones of influence. Today, the effects of his activities merge until virtually all of the air, all of the water, and most of the land is modified. We have seen the effects of changes in one resource directly affecting one or both of the others; the development of areawide air pollution markedly affects both the agricultural and urban uses of land; water—grossly overtaxed by waste—becomes a massive air pollution problem; and redistribution of the waters of the state can completely revolutionize land uses of all types, including the location of population centers.

3. There is a two-sided aspect to the emerging environmental changes in California. The first side is recognition of the extent to which man's activities are resulting in far-reaching and perhaps irreversible changes in his environment. The other side is recognition of the equally far-reaching and perhaps equally irreversible effects of these changes on Man, Himself. In the presentations to follow, these changes and their interrelationships will be explored. Merely recognizing two sides of this coin, however, is not enough. We must use this awareness as the basis of our planning discussions over the next twenty years.

The Water Resource

W. J. O'Connell

If conservation, use and distribution of water are intelligently managed by a state or federal "water master," there *is* adequate surface and underground water in California.

The supply of water will come from maximum upstream storage, pumping of spring runoff to offstream storage, and mining of the underground basins (which will involve reclamation of water and replenishment of the underground supply). Some of the reclaimed water

will come from agricultural drainage—with increased efficiency being used in irrigation practices. (Even saline and brackish water are apt to be involved in our total water use.) By 1980 water will be recirculated and reused for industrial purposes.

The greatest area of conservation will be in agriculture, which may well lead to even better agricultural yields. Reconstitution of streams may be expected to maintain and enhance the fishery yield. Here, regulation of the release of water will be mandatory.

Of greater concern than the quantity supply will be the 1980 water quality requirements and needs. Control of saline degradation will be undertaken, and we can look forward to federal grants-in-aid to control pollution, as well as for flood control and recreation. While concern is felt over the multiplicity of duplications in authority and jurisdiction in handling water, by 1980 pollution control may very well be back in the hands of the Department of Resources!

Finances will come from taxes (statewide, local and special district); revenue from power, water sales, and recreation fees; and federal and state grants. Of greatest importance to most people will be the attaining of maximum use of water for recreation and fisheries, and the protection of agriculture in community developments. Water will be distributed in areal allocations making use of usufructuary grants—made in the broadest of public interest—and set up in such a way as not to deny later developments in the area of origin.

Frederick Bold

Riparian rights, as a means of adjudicating water rights in instances of water shortages, are becoming archaic. They were originally based on a common law concept and developed in England to prevent trespass over lands that adjoin a stream. Now the facts to be considered are:

1. The interest of the water users in areas where the water originates;
2. The interest of protecting an economy that has been built up in reliance on an existing supply;
3. The quality requirements of the water user and the consequence of degradation of that quality; and
4. The relative economic demand of various localities for supplemental water.

Harvey Banks

Inasmuch as major water projects may require twenty years or more to be put into operation, now is the time to begin thinking in terms of what we should be doing that will be effective in 1980. Historically, we have developed the bulk of our water resources in order to facilitate

the utilization and development of other resources—actual human needs being relatively small in the over-all picture. *Now* all utility development must be soundly based on long-range land use plans, considered on a statewide or regional basis.

We are dealing with two scarce items: the resource itself and the funds with which to make the resource available. Therefore, much greater thought must be given to the proper allocation of the resource with due consideration to the economic and social aspects involved. In other words, in community development, coordination must be attained between water, highways and all other ramifications and facets of human activity involved in the implementation of such plans.

Discussion

The discussion of the presentation on water resources brought out the following points relating to conversion of sea water and reclamation of waste water:

1. With present costs of conversion greatly in excess of costs of water from other sources, conversion of sea water will come first in special areas such as Santa Catalina Island and San Diego;

2. Best use of converted sea water may be as a "sweetener" for highly mineralized ground water.

3. Conversion of irrigation drainage water in areas such as the Salton Sea and lower San Joaquin Valley will probably precede conversion of sea water on a large scale.

4. Reclamation of municipal sewage will probably come first of all, if current studies in Southern California demonstrate the safety and suitability of such waters for uses involving human contact.

The Land Resource

Daniel G. Aldrich, Jr.

I have felt that the purpose of our meeting today is to share views with the "Group of 50," toward the end of assuring ourselves that the material presented at the "CONFERENCE ON MAN IN CALIFORNIA—1980's" in early 1964 represents the best available information. Consequently, as I comment this morning about land use in California, 1960–1980, I will be speaking strictly in outline fashion about those items which I feel, at this point, should be considered in any position-paper on land resources.

As background for my remarks, I would like to picture for you what has happened to the 103 million acres of land in California which we have inherited.

Land, water, and people are prime factors in the development of any agricultural enterprise, and certainly have been involved significantly in the growth and character of California agriculture. A kaleidoscopic view of land use and agricultural development in the state during the past two hundred years provides illuminating evidence concerning the interplay of these factors.

During the period 1769 to 1821, Spain established a string of missions, presidios, and pueblos up the California coast from San Diego to Sonoma, where it met the Russians moving southward. The padres, soldiers, and citizens grew what they ate, and made much of what they drank, used, or wore.

In 1821, Mexico threw off the yoke of Spain and promptly set about to secularize the missions. The local citizenry took over and went into ranching on a grand scale, with their horses and cattle grazing on the lush grasses of the fertile valleys. This was the period which gave us our rodeos and saw the start of the great overland emigration from the eastern United States and Europe. Uncle Sam soon looked past the Rockies and sent Captain Fremont westward. Later the miners came in their mad scramble for gold in 1849.

The new state of California waited a dozen years or so until the middle 60's and then passed the fencing law. This law placed responsibility on the cattlemen if their cattle damaged the settler's crops, and started the bonanza grain farming era. Grain occupied the valley lands and cattle were forced onto the terraces and neighboring foothills.

In the late 1800's, facilities for irrigation began to be developed as we know them today and irrigated orchards, vineyards, and other intensely farmed crops replaced the grain on the valley land. The grain was planted on the terraces and uplands, and livestock moved further into the foothills and mountains.

Since the advent of World War II the rich valley lands have more and more been occupied by factories, freeways, homes, shopping centers, recreational areas, etc. Irrigated agriculture has shifted more and more to poorer lands, grain is planted still further up the terraces and foothill slopes, and the cattle and sheep graze beyond the grain.

I am interested in providing this background for our discussion because certainly as we consider land use today and in 1980 we cannot get away from the fact that water, land, people, and air interact.

I am now suggesting, therefore, that we give consideration to a few of the guiding principles which govern land use. Hopefully, the outline which follows covers the cardinal points which should be developed in a discussion of land resources.

The Changing Pattern of Land Use in California 1960–1980

Part I. Introduction
- Background
- Guiding Principles
- Land Problems
- Land Policy Highlights

Part II. The Present Situation
- Our Use of Agricultural Land
  - Land-use suitability classes for non-federal, non-urban land
  - Land in various classes
- Pasture and Range
- Timber
- Wildlife
- Outdoor Recreation
- Farm Land Tenure

Part III. Resource Requirements and Potentials
- Assumptions and Economic Framework
  - Population and income
  - Projected utilization of farm products
- Farm Output
- Crop and Pasture Yields
- Pasture and Range
- Timber
- Non-agricultural Land Requirements
  - Urban and built-up areas
  - Recreation and wildlife areas
  - Public installations and facilities
  - Miscellaneous other areas
- Major Land-use Pattern and Shifts, 1960–80
  - Multiple uses
  - Outdoor recreation
  - Fish and wildlife

Part IV. Policies and Programs

The Air Resource

Philip A. Leighton

Land, man can improve. Water, he can both improve and transport. But air, he only contaminates. He must make do with the natural supply of air and direct his efforts toward keeping contamination within ac-

ceptable limits. These limits have already been exceeded over most of the heavily populated areas of California.

The phenomenon chiefly responsible for this situation is photochemical air pollution. It is responsible for eye irritation, crop damage, visibility reduction, and undetermined effects on health and happiness. Even now, some 70 percent of the people of California live in areas subject to eye irritation, 80 percent in areas subject to plant damage, and 97 percent in areas subject to visibility reduction. Through these effects, the air of California is fast becoming not a resource but a liability to the continued development of the state.

The pollutants chiefly responsible for photochemical air pollution are oxides of nitrogen, which come from all combustions, and hydrocarbons, which come chiefly from the use of petroleum fuels. Motor vehicles are responsible for about half of the nitrogen oxides and two thirds of the hydrocarbons. Partial control of the hydrocarbon emissions is now anticipated, but no important controls of the oxides of nitrogen are in prospect. Projections into the future on this basis permit only one conclusion: photochemical air pollution will be severe in California in the 1980's. Its character will change, however, with nitrogen dioxide occupying a relatively greater role than it does now.

As minimum steps to meet this problem, controls will be required, not only of motor vehicle hydrocarbons, but also of hydrocarbons from other sources. But the history of such controls has been that they are never complete. As the population increases, ever more severe, ever more costly steps are demanded just to hold the line.

This is a basic weakness of the control philosophy, and only by a more fundamental approach to the problem will a satisfactory and lasting solution be found. This approach is to *abandon combustion,* in favor of pollution-free sources of heat and power. Such a change will occur eventually in any case, as fossil fuels are exhausted. It is suggested that the greatest reward, for the money and effort expended, will come, not from stopgap controls, but from steps taken to accelerate this change in energy sources.

* * *

Editorial Comment

In making his presentation, Professor Leighton used a series of slides to illustrate his points. His slides showed:

1. The geographical areas in California now subject to visibility reduction and plant damage.

2. The sources of contaminants responsible for photochemical smog.

3. The chemical changes that take place in the atmosphere when it is irradiated with sunlight.

4. Projected changes in population, hydrocarbons and nitrogen oxide.

5. Projected effects of the state's motor vehicle exhaust control program.

6. Estimates of the chemical composition of air in California's urban areas in 1985, if only the presently proposed motor vehicle controls are applied.

Finally, Professor Leighton displayed a transparent chamber containing nitrogen dioxide to simulate the color one would see in looking at the sky through three miles of urban air in a metropolitan area in 1985, unless ways are found to produce energy by some means other than combustion of petroleum fuel. The color was approximately that of bourbon whiskey.

The Food Supply

Emil Mrak

In this Conference, I think we might go somewhat into the history of man—bring it up-to-date and lead into some of the problems that concern food production, processing, and distribution.

There is a squeeze that's being put on agriculture as a result of taking out good land, the cost of handling crops on the farm, developing new equipment, and the fact that when new equipment is developed five new problems are created for every one solved. The cities are growing out to the farm areas, and farmers are declared public nuisances. I've known some of our Aggie graduates who have had feed lots in the country for years. Cities are now growing out to their operations—certainly they aren't growing to the cities. Now, some of these farmers are experiencing injunctions against their operations, because they smell, or the chickens bring flies or are noisy.

How far do we want to go with respect to the future? When we reach the day of no surpluses, we will be worrying about sources of sufficient food for this country; and if this day does come, what are the possibilities of developing new foods (proteins) directly from plant crops?

Another aspect of the problem is that related to the use of chemicals and pesticides, and the safety of our food supply. I would like to get into the reasons why these chemicals are used; what can be done and what is being done to control them to assure the safety of our food supply. What are the prospects for the future? I would like to point out that the food producer finds himself in a bind, because on the one hand he is compelled (you might say) to produce food at a low cost per

pound or ton, and in order to stay in business he must do this with a more intensive effort under adverse conditions such as mentioned above. He must produce the best of quality, even to the extent of considering the esthetic values of foods. If you go into some countries you can see the jobbers selling half-rotten tomatoes at half price, but such a situation isn't possible here. It would not be tolerated by the Food and Drug people or by the consumers.

Then again, the farmer finds himself in an even greater bind, because if the eggs of fruit flies are found on some of the fruits or vegetables, the Food and Drug Administration will consider these "esthetically unsound" and "products that should not be sold." So the food producer is faced with the requirement for high standards, high production costs, and taxes. Do we find a balance here? In the future, believe me, when the food supply becomes short, this is going to be more and more difficult. These are points I would like to cover. I would also like to get into another aspect of the safety of foods that I believe is far more important than chemicals. I have often said that to my knowledge there has not been, in this country, a proven case of cancer or poisoning from eating foods contaminated by agricultural chemicals.

In Iceland, there has been evidence of carcinogenesis by smoked salmon. The fish is smoked very heavily and the natives eat this food literally several times a day throughout the year. They seem to like it, even though so much, eaten so often, is undesirable. As far as I know, there has never been a case of this type in the U. S. Of course, our eating habits are such that we don't ingest smoked salmon three times a day. I personally like it and still eat it—but not in excess.

I believe there is another extremely important aspect of the food problem developing in this country. It is microbiological rather than chemical in nature. There is an increasing number of food intoxications caused by microorganisms, and as our population becomes more congested we can expect these problems to increase. We're closer to the animals, the animals are closer to each other, and diseases can be transmitted (zoonosis) not only from one animal to another, but also to man.

We will have to reuse our water as time goes on. We are distributing different types of foods than we did only a few years ago, and these can and have caused microbial problems. We have many convenience foods, including many frozen foods, and these foods are usually perfectly safe when they leave the factory, but they may undergo undesirable changes during distribution—or even in the home. For example, frozen stuffed turkey may be perfectly fine when it leaves the freezing plant and even when it leaves the store, but the housewife may actually incubate it at

a low temperature in the oven for hours and then she may really get into trouble because of staphylococcus poisoning.

These are the types of food intoxications that I believe will present more problems in the future. This problem is increasing all over the world, and it is serious.

The Japanese have found a new type of organism that is extremely small, yet it is larger than a virus. This organism causes a severe type of food intoxication and yet we are just starting to realize it. This, to me, is far more important than the agricultural chemicals, which are watched carefully.

There is still another type of microbial intoxication that seems to be increasing with the changes in production and handling of certain foods. It goes right back to the soil. A year or two ago, about 30,000 turkeys mysteriously died in England, and their deaths were traced to defatted peanut meal produced in Africa. Now it is known that the meal contained a mold (*Aspergillus flavus*) that produces one of the most carcinogenic compounds known, and this, of course, is what killed the birds, which are particularly susceptible to it. Recent investigations indicate that occurrence of the mold is not restricted to Africa. Why was this not observed years ago? What changed? Perhaps the meal is produced differently—or is it the handling or agriculture?

Japan is importing rice that sometimes develops a penicillin mold. Recently this, too, has been found to be toxic. Its development is related to moisture content and handling procedures, which may have changed.

The general point I should like to make is that as our population grows, as our mode of living becomes more intense, as plants and animals are grown closer together, and our entire food operation becomes more intense and congested, the situation is bound to require more technology, more precision and, above all, more education and understanding on the part of all. Otherwise, we will be confronted with some real problems—even a shortage of food.

Transportation

Harmer Davis

In discussing transportation, we must ask "Who are the people to be served—employment-wise and in terms of age?"

Transportation is a service determined by the facilities and the vehicles which provide it. They may be simply a compromise of political forces, which reflect the social and economic forces.

We are faced with two basic assumptions:

1. We no longer find the causal relationship that existed 100 or even 50 years ago, between economic growth and provision of transportation.

2. *Now,* transportation must be the kind of service which will provide the best opportunities for underwriting that development and growth. We should not expect a great investment in transportation to insure economic growth (as in former years).

Also, when transportation alternatives are offered it is up to the consumer to choose, and we don't *know* what the consumer's choice will be.

Key questions that will have to be answered by transportation planners of the future are: What quality of transportation are we to be provided? How can the new transportation facilities (in combination with other factors) foster a healthy environment?

Consideration must be given to population (employed, or leisure time), income, productivity, and industrial location, for all of these factors will color the gross transport demand where concern is with "passenger miles" and "ton miles."

What are some of the implications of increased productivity?

If we are moving into an era where the service industries hold much more important implications for transportation, this may mean

a greater diffusion of effort;
a different transportation pattern;
even a different quality of service.

Within the memory of living man, we have developed an industrialized civilization that has resulted in unprecedented urbanization.

Technological implications could make for a markedly different quality and quantity of transport service. There may be better vehicular power packages.

Inevitably the premium on higher speeds will change the complex of our transport system. Telephone communication (closed circuit) *may* take the place of travel—where conferences are concerned.

Priorities should also be given so social and esthetic values in future planning. An example of this might be called "the view from the road."

Livelihood

Irving R. Tabershaw

Man's means of securing a livelihood determines where, how, and under what circumstances he lives. One of the most important factors is the effect on man (in California) of his changing work conditions,

i.e., the type, security, and stability of work opportunities, the rewards (in money, satisfaction, or recognition) and the daily and special environmental hazards.

Our thesis is that the elements and situations which adversely affect the physical and psychological well-being of the individual and the community, make work unrewarding and ultimately abolish work opportunities. The converse is also true. The environment of man's place of work inevitably orients the standards of his total environment and affects his reaction to his own and group work efforts until in time they blend together.

Most dramatic in California has been the large upswing in the manufacturing industry. In 1962, the labor force in California totaled 6,200,000; 1,300,000 were employed in manufacturing. The greatest growth occurred in missiles, aircraft and electronics manufacturing which increased 280 percent between 1950 and 1960. Its productive research and technical skills, and its geography, climate, road systems, and self-sustained agriculture make California better equipped to withstand an atomic bombing attack than other parts of the U. S., and, therefore, it is more likely that defense industries will continue to come here.

The Metropolitan Life Insurance Company indicates that Americans have attained a new peak (70.5 years) of life expectancy at birth. In-plant injuries and occupational disease rates have gone down, but chronic disease rates have risen proportionately so that, at present, the working environment is apparently more healthy than the environment of the non-worker. On the one hand, technology has controlled many of the health and safety hazards in industry; but, on the other hand, some of the new chemicals and new processes are so complicated and so different that changes in our thinking and techniques are necessary. Defense-connected industries, particularly, are producing local working environments necessitating control methods similar to those used in space exploration.

While moving away from use of physical labor, California industry is increasing the technical, social and emotional stresses of its workers. By 1980 we will need every cushion available to soften the impact of this alienation from work satisfaction (one escape is the opportunity for participating in sports which in some part may minimize the psychological work pressure).

Farming—and California is the leading state in agricultural cash income—is becoming more and more organized like the small industrial company. This industrialization of the farm, and the urbanization it fosters, leads to concentrated conditions of living.

Besides the trends in manufacturing and agriculture, a third force

is beginning to make itself felt in California. In the last five years, there has been an increase in the number of retired individuals. As people get older, health becomes the predominant goal. California could easily become the "spa" of the United States. The pursuit of health, recreation, and leisure provides the basis for major industries which must inevitably increase in California.

People will come to California either because of the work opportunities or attractive living conditions. Their very numbers will affect the environment and Man, Himself.

Shelter

Catherine Bauer Wurster

In California we have to look at the housing problem primarily in terms of growth requirements. Our metropolitan population will double again within the visible future, and the opportunities and limitations of the future housing market will not only determine the kind of shelter available for family life but also, to a significant degree, the over-all pattern of population distribution and civic organization.

One of the major issues is "sprawl." If the trend toward lower-density residential development in scattered tracts continues, the marvelous natural amenities which induced many of us to come to California will be largely lost in all our major metropolitan areas. Scatteration is also expensive, in the cost of services and in inconvenient communications. If we want both amenity and efficiency, we should encourage large-scale programs of open space conservation, on the one hand, and more compact types of urban development and housing on the other.

Another issue is the trend toward social cleavage and conflict within the metropolitan complex. Increasingly, the older central cities are tending to become primarily the abode of the disadvantaged, the poor and the aged, and above all the racial minorities, while the newer suburban communities are predominantly middle and upper class families with children, and almost wholly white. This pattern makes it increasingly difficult for a great many people to live near their job opportunities, and it also threatens the success of central renewal programs by intensifying social and tax base problems. These trends are caused by rising limitations in the housing market, which hardly serves more than the upper-income half of white families in new development today. To create better balanced communities and sensibly organized metropolitan areas, in the course of future growth and development, new policy and planning tools are beginning to take shape, necessarily at the state and federal levels.

Edward Eichler

Our report[1] emphasizes the following trends:

1. If the population doubles from 1960 to 1980, we shall need to build five million new units during that period.

2. Both homeowners and renters are paying a high share of family income for housing, and the share has been rising in the state while it has been decreasing nationally.

3. The new housing market has been shrinking in its ability to serve all income groups. Soon almost no families earning less than the median income will be able to afford new housing. This could be put another way by saying that costs are rising faster than income. This is especially important in light of the population explosion, for we cannot rely on the older housing supply to serve lower income groups. If we don't broaden the market we shall not build the five million units. We shall experience an increase in the number of substandard units and an increase in the journey to work.

4. The older sections of cities, mainly in response to the narrow market for new houses, are becoming more and more the home of the minorities, the elderly and other people who are disadvantaged by lack of skill and low income. The narrowing of the market can only accelerate this trend. It has grave political, social, fiscal and economic implications.

5. Land has been a major contributor to the increase in cost. The cost of the finished lot rose at a rate ten times faster than either the consumer index or construction cost. We also see a trend toward lower density which might mean that we would use twice as much land for the next five million homes (if we build them) than for the present five million. Not only does this raise the cost of the house but it could seriously impair communications and reduce the supply of land for public purposes.

6. California is short of capital to finance its rapid growth. Thus mortgage money is bound to cost more than in the East. This is especially important when one considers that interest is over fifty percent of the cost of housing, and that we shall have heavy demands for funds for public purposes such as transportation, education and water.

We found that federal and state programs have not even been designed to cope with such problems and that because California is a growth state with high standards and costs, most federal programs are inadequate or irrelevant. The basic question seems to me to be whether the state can marshal its own resources as well as those of the federal government to achieve the following:

[1] Report of the Governor's Advisory Commission on Housing Problems.

1. Housing in all areas which will serve a much broader market in terms of price, type, quality, the journey to work and community facilities.

2. Much greater diversity and beauty in our residential development.

3. Vehicles which will aid the private builder to meet public purposes and also to make a profit with a minimum of restraints. We are beginning to get a professional industry in this state. Government should try to accelerate this trend and establish a legal and financial framework which will cause it to move in the right direction.

4. The creation of communities of sufficient size and balance so that there can be an effective political system and fiscally viable government.

5. Stabilization of land cost and an increase in density.

To accomplish these, we must consider the use of federal and state funds for mortgages and for land development and purchase, a change in the tax structure, laws and other efforts to eliminate racial discrimination in the sale and rental of housing, the programming of state and federal efforts of all kinds to take these goals into account, and some system for the continuous development and dissemination of information about the market and these other problems.

Recreation

Elliot Schrier

Any thoughtful, detailed consideration of the problem of leisure—its definition, availability, utilization—requires consideration of all of the other problems we are considering today: our physical environment, rural-urban balance, housing, work regimen, transportation system.

In a provocative, scholarly book published last year, *Of Time, Work and Leisure,* Sebastian de Grazia takes stock of the misutilization of our human resources. To de Grazia, in the past century the changes in man's leisure generally have been changes for the worse. He sees the world of tomorrow as a dismal place if we do not take stock of the present situation and make changes dictated by prudent analysis of where we were, where we are, and where we seem to be going.

On housing: "The influence of shelter and architecture as a shaper of how man spends his free time is enormous. . . . Without grandparents in the house, the free-time activities of parents remain confined to that house or to the few hours a week they can afford a babysitter. . . . Houses built nowadays often have a special room for TV, so the set plus comic books at least takes care of tales for children, and fills many of the parents' free-time hours as well."

On the city: "Since the American has moved farther from work, the slowing down of city traffic . . . has cut deeply into the American's free time. Without squares for people to gather in, a city increases the pressure to meet within houses, cuts down the range of contacts, raises the cost of a part of free-time activity by requiring it to go on in commercial, roofed-in buildings, and increases the dependence of public opinion on centralized, house-penetrating means like the radio and TV."

On working conditions: "The American, even after subtracting the hours he lies down for sleep, spends most of his 24 hours on his rump. Work may be so exhausting mentally or physically that it leaves free time heir to passivity. On the other hand, it may be in so well-cooled or well-heated an environment that one will shirk free time outdoors just because of heat or cold."

The availability and utilization of leisure or free time reflects all other factors of contemporary society. Whether the net result of these factors is that man's plight away from work is worse or better, the fact remains that more people are spending more time and more money than ever filling a greater number of hours per week away from work in what they rightly or wrongly call their free time.

The subject of planning for mass leisure may be divided into two phases, urban and rural. Obviously, we cannot expect to empty millions of people every weekend from our urban areas into the seaside, river and mountain recreational areas. Additional opportunities for widespread leisure activities will have to be provided within the metropolitan complex. But what facilities should be offered? There are passive as well as active pursuits, including the performing and graphic arts, the handicrafts, continuing education, and great books.

Considering the years ahead, *Changing Times* says, "Visits to the national parks have been increasing at a rate of 8% a year, to the national forests 10% a year. Should entry to these parks and forests be limited? Should they be made year-round facilities? Should fees be increased? In the cities, there will be campaigns to clear slum areas and replace them with recreational areas. The practice of allotting local parklands for highways, expressways, parking lots, or even industrial and commercial developments will come under fire. And there will be public clamor to buy up land now for recreational use in the future."

William Penn Mott, Jr.

Time will permit a brief discussion of only five major areas to which our attention should be directed, if we would resolve the questions that will face us in the next twenty years: 1. education and research; 2. planning; 3. fees and charges; 4. environment and attitudes; 5. unification.

1. *Education and Research.*—Unless a program of education is established at all levels, future generations will have very little understanding of the need and reasons for wise use of our open space resources. An uninformed public will, because of ignorance, allow the wasteful erosion and exploitation of our open space resources, and fail to secure full enjoyment and benefit from outdoor experience. In acquisition of the open space resources which future populations may need, we are today in competition with agriculture, housing, business, and industry. Millions of dollars could be saved if scientific research could be focussed on the reasons why people need and want recreation, and on the development of new materials and supplies (used in construction, maintenance and development) so that these items might be secured at the lowest possible initial cost.

2. *Planning.*—Park planning has suffered because there has not been sufficient factual information available as to the need for it, and the need to support standards and criteria. Planning has not been of high quality, nor has it been imaginative and creative. This is both wasteful and destructive of the open space resources that have been acquired; and people visiting these parks and forests, because of mediocre design, have not received the stimulation and inspiration that would otherwise be provided.

3. *Fees and Charges.*—Parks and forests will have to be restricted as to capacity, lest the very reason for their acquisition be destroyed by the people who sought their preservation. The "user pay" concept may provide protection by restricting use, and also provide revenue to offset rising development and maintenance costs. In 20 years we may accept paying for the privilege of hiking in a truly primitive area as willingly as paying for services provided in a highly developed area.

4. *Environment and Attitudes.*—People compromise their attitudes as environment inevitably changes and they gradually accept the results. To modify this process, those who manage parks and forests will have to plan to give the public what they *want,* not merely what they will accept, preserving as much of our open space resource as possible for future generations to enjoy—unspoiled—or to be developed at a future date, as conditions warrant.

5. *Unification.*—At present there is no unified force or organization with the sole purpose of safeguarding and protecting the open space resources of the state or the nation. Such a force is needed for a rallying point in order to protect and preserve these open spaces from encroachment. Those who work together must agree that they have a common goal and cooperate in a totally coordinated effort to protect, preserve, and develop this priceless asset for the greatest good.

Changing environments, research, education and sound planning cannot be accomplished without the expenditure of large sums of money. Utilizing existing service and facilities will reduce costs; recognizing the fact that leisure may be a destructive force—unless properly directed and spent—will certainly justify giving this problem more than passing consideration. Unless we solve the question of what to do with our leisure time, solving the great questions of land, water and air will be to no avail.

Man, Himself

Jesse Hobson

We have the paradox in California of four of the very greatest universities thriving—Stanford, Cal Tech, UC, and USC—and at the same time, technology is giving us problems of pollution of air and water; shortage of water supplies; problems of land usage. Apparently education is not mitigating these untoward effects.

Education is a tool for shaping the future. It must be tied in with the problems we're discussing today. We feel a certain sense of economic responsibility—but not enough. We don't feel very much social responsibility, and we feel even less political responsibility. Do we *know* what kind of a culture we want, or what kind of a society?

And, least of all do we feel responsible to ourselves. All of our science and technology must have direction. It must have the direction of people who feel social and ethical responsibility and purpose.

In education today, we can see certain trends. We can see the trend toward centers of advanced study, interdisciplinary study. We're using interdisciplinary approaches between the university, industry and government. There is an opportunity and an urgent necessity for these combined efforts—these interdisciplinary or team approaches (combining the physical sciences, life sciences, social sciences and the behavioral sciences, even the humanities, the arts, and religion) to work on the problems of the mind of Man, Himself. Perhaps the greatest weakness and danger—perhaps the greatest problem, as well as our greatest opportunity in this last half century of the 1900's is Man. Education is meaningless—unless it leads to some kind of satisfaction, self-purpose, self-identification and social purpose.

Today, it is not doing that job in California or elsewhere. There is no coupling between our educational systems and the problems of California. What kind of values are we developing, what sense of values?

In Rabbi Leyman's *Peace of Mind,* he pointed out that in dealing

with Man, Himself, we're going to have to come to the point where we combine the approach and knowledge of physical, chemical, biological, and psychological sciences, psychiatry and religion. We're still in the period of the Dark Ages as far as our mental and spiritual health is concerned; we're still in a period of ignorance and superstition and prejudice and false standards of conformity.

We have freed the human mind for creativity in the areas of science and technology in the physical world, but the mind of Man is still bound in areas of motivation and ethics and morals, social responsibilities to Man, Himself, and to his family, his social group and his society.

As individuals, as Californians, even as a nation—and to an alarming extent as Western Civilization, itself—we seem not to have enough sense of purpose. We don't seem to have much sense of destiny. There is all too little constructive motivation. We're not finding self-satisfaction. Our image and our vision of the future is sort of fuzzy—it's self-centered, it's frustrated, and it's without enthusiasm or purpose.

This is the greatest problem of Man in California now and in the decades which lie ahead. The greatest asset of California is its people's *brains.* But those brains have got to have purpose and direction, and those brains must live under conditions which bring satisfaction and peace of mind.

Four hundred years ago, Michelangelo had just finished painting "The Last Judgment." As much change as has occurred from then to now as will come between now and the year 2000!

I'm not sure we can take it. I'm not sure we can *think.*

We come back to the exclamation of the Psalmist: "What is Man that Thou are mindful of him?"

What *is* Man that he can respect himself and that he can learn to live with himself—and with his Brother?

Reverend Paul W. Yinger

Man, Himself, must seek for the content of life. Each one alone will have to wrench the meaning of the world from his surroundings. And in his living, Man must act with all his heart and mind as though the universe intended to provide every man in every age the chance to see the heart of meaning. Man must find out what it means to live, and he must meditate upon his living, seeking always to identify himself: "Who am I?" "What is Man?"

Though we have all that we now want, and learn to satisfy needs and tastes and interests not now dreamed of, but gain no sense of having received an authentic stamp upon our individual existences, there will be nothing to it. Nothing at all.

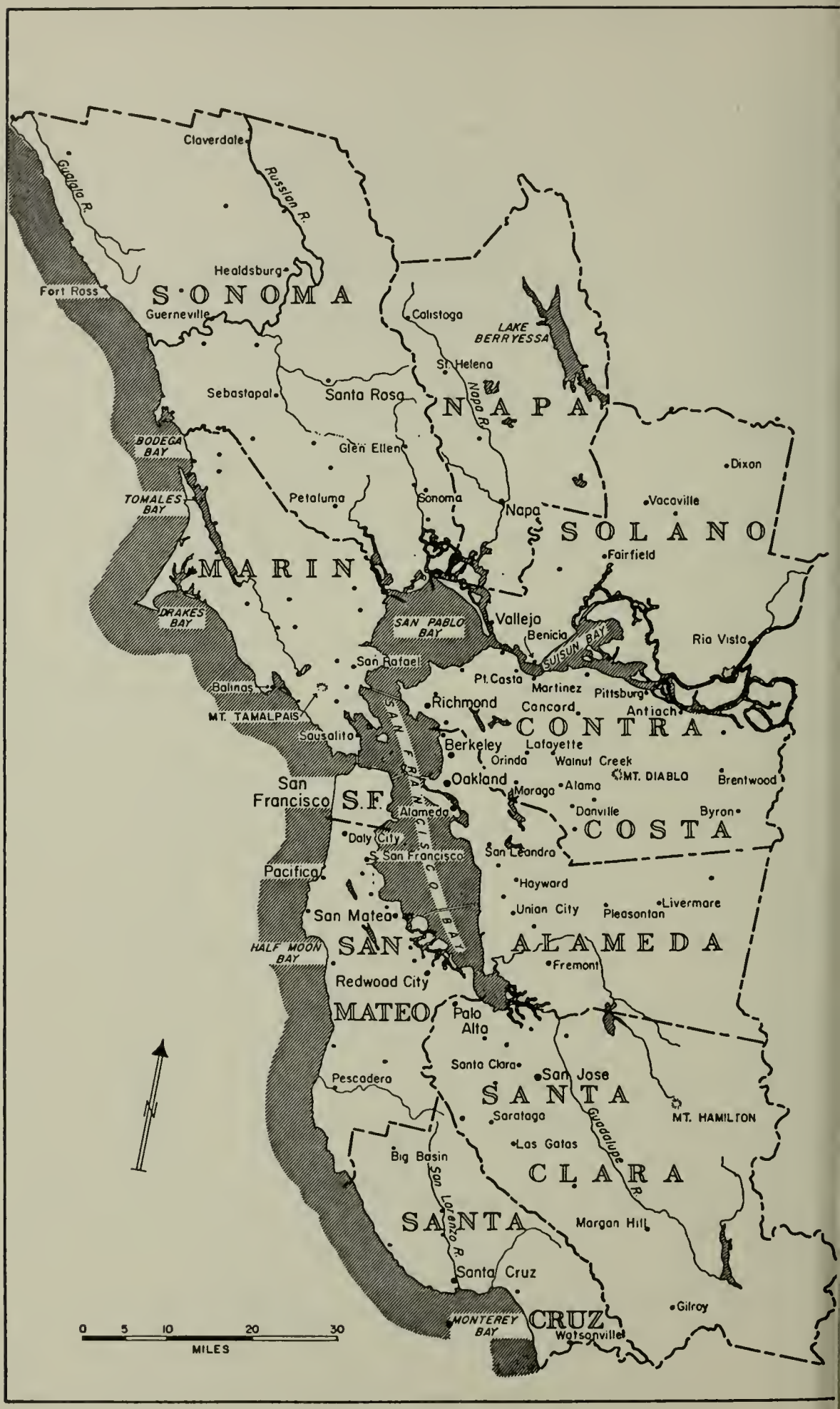
"Man himself must cut his way through the complexities of his existence,
And keep working at the real world
In which he is one of the eternally frustrated laborers;
And in the process of giving and receiving for the common good,
He will find moments of exquisite beauty that will
Spring out to surprise him, and hours of heart's content
That will sustain him by their mere recalling.
As Man sweats and groans his way through tasks
Which only partially satisfy his longing for a self
Completely lost in labor, love and praise,
He can yet see the total good which comes not from his own hand
But is the surrounding atmosphere of a universe
Where point and purpose are revealed
Only in adoration of the Ultimate which is beyond reach or knowledge."

V

JAMES E. VANCE, JR.

GEOGRAPHY AND URBAN EVOLUTION . . .

Geography and Urban Evolution
in the San Francisco Bay Area



MAP 1: BAY AREA PLACE NAMES

INSTITUTE OF GOVERNMENTAL STUDIES
University of California • Berkeley, California
DWIGHT WALDO, Director

Geography and Urban Evolution in the San Francisco Bay Area

By
JAMES E. VANCE, Jr.
Department of Geography

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Preface

San Francisco has often been called unique, and it is an article of faith for many residents that uniqueness is the city's one distinguishing quality. But uniqueness is an attribute of all places—obviously no two cities can share the exact same location, and no two cities may have an identical combination of conditions. This fact of uniqueness alone thus does not tell us much of importance. To comprehend the true uniqueness of a place we must also understand those characteristics it shares with other places. Only by placing an individual city alongside the "measuring stick" of cities in general can we understand it. Consequently, this paper will seek to determine how typical is the San Francisco Bay Area. Merely to catalogue the uniqueness of San Francisco or the Bay Area would be a literary exercise with no place in serious analysis.[1]

For any meaningful discussion of an individual city, we must constantly ask "What *is* the American city, in general terms?" Among other things, the American city is a massive physical structure whose lineaments come from certain *allocative decisions* made in the past. As we shall see, San Francisco was a geographical generalization before it was in any sense precisely located. And once San Francisco was sited at the end of its peninsula, it began to expand into a metropolis which came ultimately to encompass most of the early rivals. The first allocative decision thus locates the *city in space*.[2] In the early stages of urban settlement, there was no central city within the San Francisco Bay Area, allowing vain hopes to San Jose, Alviso, Benicia, and New York of the Pacific.[3] But there was never any real doubt as to need for such a core. Once the "city in space" had been established at what is now San Francisco, a different set of controls came into operation.

A second type of allocative decision centers on the use of *space within the city*. In the study of a metropolis, such as the Bay Area, this process assumes much greater interest and importance than does the concern for central place. Once a city is founded, it is the choices in the use of land

[1] In this study the name "San Francisco Bay Area," or just "Bay Area," is always intended to have regional denotation where used, even in reference to an area or feature within the city of San Francisco. "San Francisco" used alone always refers only to the tip of the peninsula occupied by the City and County of San Francisco.

[2] Such a decision process has since the early 1930's been associated with the writings of Walter Christaller and central place theory. In our present study we are concerned with such a theory in only the most limited sense, as the need for a metropolis in northern California is taken as self-evident.

[3] Present-day Pittsburg.

within the city that concern men intimately. Spatial position appears to be determined far more by national trends of economy and development than by purely local initiative, although one would not wish to argue along deterministic lines that a city has *no* control over its place in space or its importance in national economic and cultural affairs.

Specifically, it is hard to assign importance to local boosterism in the growth of an individual California city when all such cities are growing, as are most cities in the whole of the West. But inside the metropolis the allocation of activities takes place in a closed spatial system, locally based, making possible considerable variation and control in different areas. By looking at the historical sequence of decisions governing the use of the scarce commodity, local land, we learn much about the life and culture of the metropolis.

This paper—part of a series of monographs that study many aspects of the Bay Area metropolis—will attempt to establish the physical structure of the region and the way it grew. We may at first question whether there is any point to looking at the structure of the individual metropolis. If uniqueness is a much exaggerated characteristic of cities, and many decisions as to the use of land are taken in a broad cultural context extending at least to the nation as a whole, it may quite honestly be asked, "What is to be learned from the individual city or metropolitan area?"

The answer to this questions has two parts. First, we seek to understand each metropolis as a physical site where man carries on his day-to-day life. Although it is fatuous to make too much of the San Francisco Bay Area's "uniqueness," it is equally dull-witted to act as if the Bay Area functions, spatially, just like all other metropolitan areas in the United States. As Richard Zettel's study of transportation shows, for example, the Bay itself is a very significant feature, and nothing quite like it is found in any other American metropolis.[4] Thus, a study of the geographical foundation of the Bay Area is fundamental to an understanding of the directions and patterns of urban growth.

Our second reason for studying the physical structure of the Bay Area metropolis is to determine for this individual area the *processes* at work in shaping the region. It may be argued, just as in the case of cultural influences on decisions, that there are certain general processes operating to create generalized structures for cities. Such an argument is valid but incomplete. There are also differences in the impact of the various processes, and occasionally there are peculiar processes not found elsewhere. Specifically, in the Bay Area speculative expectations from changes in

[4] California, University, Institute of Governmental Studies, *Urban Transportation in the San Francisco Bay Area;* by Richard M. Zettel, 1963.

land values have a completely different scale from those in many older eastern cities.

Urban structure is the product of a whole series of allocational decisions whose effect is cumulative. Once a city has been sited it cannot deny its site. As much as San Francisco has tunneled, bridged, cut down, and filled, it still has an eccentric location and a rough site. Again, even though its original street grid was an expedient acceptance of squatter's buildings, that basically adventitious arrangement is fossilized in the vast investment represented by the city's physical plant.[5] When we look at a city today we are observing a museum. As in a museum we may wonder why some acquisitions were made, partly because taste changes and partly because we may not perceive the original function of the purchase.

An exhumed burial urn may seem bad pottery and pretentious. Rubens may seem dull except to the connoisseur with sufficient knowledge to derive intellectual interest from minor variations. Such is the case in cities. The more we understand the original purpose of a city's physical components, the more meaningful is its present pattern and the more we learn about the processes at work in the city's structure. Such understanding is far from idle in this era of urban development, when we are in real danger of repeating dreadful mistakes analogous to those of the Gothic restorers of the nineteenth century. *Nothing is more transient than newness,* and we must handle it with great caution. We must look at the physique of the city with care, intelligence, and objectivity if we are to avoid in cities the kind of prudish self-deception that put fig-leaves on statues. Let us be sure that we know enough about urban dynamics to make the results of our tinkering necessary and lasting.

JAMES E. VANCE, JR.

[5] It has become standard in the study of city origins and development to distinguish between *predictable* locations and structures, which conform to accepted generalized patterns, and *adventitious* locations and structures, which result from chance and erratic causes.

Introduction

First, we must "place" the Bay Area by considering it in reference to the "American City." Urban development in the United States has occupied a relatively short time span and has taken place within a single culture. Much as America is a melting pot of ethnic groups, it is not particularly heterogeneous in its city forms. Politically, these follow roughly on British practice of the 17th and 18th centuries. In physical shape, American cities show the same single dominant center that we find in British and West European towns throughout most of their history. Economically our cities were originally patterned after the market towns of England. As in the case of the English prototypes, industrialization later came to and transformed many of the early American towns.

This is not the place to engage in a comparative study of urbanization in America and Western Europe, particularly Britain. It is sufficient to note this heritage and to emphasize that American cities stem from a clearly defined and geographically narrow cultural background. Their internal consistencies are very great. For this reason we may distinguish a physical structure—a "physique" if you will—that is the American city. In studies of human physique we often seek to explain the individual on the basis of the norm, the somatype or the measurable deviation from the norm. So it is in urban analysis.

The Combination of Elements

Although we may begin with a denial of the true uniqueness of the San Francisco Bay Area, we must recognize that the peculiar combinations of its attributes have given it a distinctive urban landscape. That landscape forms the subject of this discussion. Like any regional setting, we may consider it both a stage on which events are acted out, and an evolving structure itself. Much of the favor in which the Bay Area is held by visitors, and the affection bestowed by residents, comes from its unusual physical setting and the use man has made of it. The historical geography of the region is an amalgam of a striking setting and uncommon events whose summation is the present *urban landscape.* To understand this we must look at the historical geography of the region, particularly the forces that have shaped the "physique" of the Bay Area.

The Beginning

"San Francisco, at the end of the peninsula, however ill-favored the site in some respects, seems topographically marked for greatness, rising

on a series of hills, with a great harbor on one side, a great ocean on the other, a mighty waters ever passing by to the outlet of the widespread river system of the country."[6] Such an assignment of inevitable greatness may be questioned today in the possibilistic frame we apply to our study of city location, but the impact of the physical site on the growth of the Bay Area is readily accepted.[7]

The coast of California is rocky and forbidding when viewed from the sea, as it first was. The grain of the land gives us the alignment of the coast. "It is a terrane younger than the eastern seaboard, wrought not by the same slow and prosy process of ordinary strata formation, but in many a fit of passion, with upheavals and burstings asunder, with surging floods and scorching blasts."[8] Despite their geological inaccuracy, Bancroft's words do suggest the careless abandon of mountain building along this coast, and its recency. These mountains are actively in formation; thus they are both sharply defined and largely unbreached.

The strong parallelism between the axis of the mountains and the trend of the coast means that valleys fail to afford access far inland. The Salinas River Valley is characteristic of the way California's coastal valleys run parallel to the coast. And the great Central Valley extends for almost five hundred miles from Redding to the "Grapevine," between the Coast Range and the Sierra Nevada, again running parallel to the coastal trend. Only in one place is its western rampart breached, i.e., in the Bay Area, where a depression of the general crest level of the Coast Range combines with two gaps through those ranges. The lower crest is accompanied by a deepening of the floor of the valleys enfolded within the Coast Range, so that the sea can flood through the western gap, Fremont's Golden Gate, to form San Francisco Bay. And through an eastern gap, known as Carquinez Strait, the waters of the great interior valley flow out through the Bay to the ocean. These two gaps afford the key to this area. However we view the situation, they provide the critical tie between the sea and the usable land.

San Francisco Bay had to be discovered from the land because of the narrowness of its opening and the persistent coastal fogs. Once found, however, the Golden Gate was widely used. The Bay of San Francisco became the objective of ships bounds for the Pacific Coast, and in 1845

[6] Hubert Howe Bancroft, *History of California*, San Francisco: The History Company, 1888, vol. 6, p. 6.

[7] In geographic thought today there is a strong rejection of the idea that the physical environment *determines* how man will live on the earth's surface. Instead it is reasoned that man has a range of *possibilities* in his use of the physical setting in which he finds himself.

[8] *Ibid.*, p. 23.

Daniel Webster wrote his belief "... that the Port of San Francisco would be twenty times as valuable to us as all Texas."[9] And this was said at a time when the Bay was merely a location where periodic trade was carried on. Up to the time of the Gold Rush, San Francisco was a regional rather than an urban designation—the small settlement was still called Yerba Buena—and even then a designation more for the Bay than for its shores.[10]

Focusing on that Bay was the largest of the valleys enfolded within the Coast Range, as well as the vast sediment-filled lowland we now call the Central Valley. Such an association meant that San Francisco Bay became the doorstep of a varied warehouse. The climatic range was from the searing heat and perennial drought of the southern-most part of the Central Valley to the cool arcadia of the Sonoma County coast. The earth itself included a structural spectrum from hard basement-complex rocks in the Sierra Nevada, through the greatly contorted and jerry-built conglomerates of the Coast Range, to coarse and fine recent sediments in the valley fill. The array of minerals produced was important. Even to this day the area combines crops such as grapes, that thrive on adversity, and asparagus, that tolerates only the most gentle approximation of soil. In the beginning, however, the profuse productivity of the area was not apparent.

California teaches us the endurance of man's concept of nature. Although there had been visitors who had described California and the Bay Area before the trek to Oregon began in earnest in 1843, no great migration turned to the south until the discovery of gold. In part the strong preference for Oregon came from its status as *terra nulius,* but contemporary comment favored the mirror image of "The United States" found in the Williamette Valley over the unfamiliar natural endowment of California.[11]

Those Americans who headed west before the Gold Rush were largely seeking new forest land for settlement. They came from relatively well-watered regions that man had won, usually slowly, from true forest. The

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[9] Quoted in John Charles Fremont, *Memoirs of My Life,* Chicago and New York: Belford, Clarke and Co., 1887, vol. I, p. 420.

[10] Carl Sauer in his 1940 Presidential Address to the Association of American Geographers was the first to see clearly the point given more emphasis here that ". . . in the 1840's San Francisco was the most eligible site for a port at which ocean and river transport met." Sauer, *Land and Life,* Berkeley: University of California Press, 1963, p. 374.

[11] Donald McKay Frost showed in a study of contemporary newspaper comment from the first half of the nineteenth century that knowledge of Oregon was widespread and favorable in the wooded frontier of Missouri and Arkansas and the forested valleys of eastern Iowa whence came the greatest number of immigrants. Frost, "Notes on General Ashley, the Overland Trail, and South Pass," *Proceedings of the American Antiquarian Society,* October 18, 1944.

break in the natural forest caused by the prairies and Great Plains split the American frontier into two parts, one located on the Pacific Coast and the other in the Middle West. Active development began in 1843 with the onset of the trek to Oregon. After that, each frontier was extended only very slowly into the dry-lands of the West. The two parts met around 1890 when the gap was closed by the effective occupation—though often only by very sparse settlements—of all land that formerly lay beyond the frontier.

The western frontier had its faint beginnings as early as the 1790's when New England merchants pioneered the fur trade with China, securing the furs themselves on what they then christened "The Coast," giving us a colloquial designation that has never left our Pacific shore. This fur trade route, which traced out the coast of California beyond the austere wall of the Coast Range, only awaited conditions more favorable to commerce. With Mexican independence, trade became possible and the sea provided the route. The Mexicans wanted goods that formed the staple of New England. At San Diego, San Pedro, Santa Barbara, Monterey, and San Francisco Bay, these staples were offered in occasional trade carried out on the decks of Yankee ships. These goods were at first bought by silver and supplies that might sustain fur-trapping farther north on The Coast. But events in New England led to a much more direct link with California.

Early in the nineteenth century the making of shoes became a factory activity. It centered, most conveniently, in the back-country behind the main ports of the Boston Men who had been trading to the Northwest for so long. Lynn, Woburn, Brockton, and Natick in Massachusetts began to devour hides, and, before the day of the railroads and large mid-western packing houses, it was easier to turn to California where Richard Henry Dana found in such abundance "... skins with the horns attached." In fact Dana's *Two Years Before the Mast* were taken up in the pursuit of this trade, which was a mingling of retailing and wholesaling. The Boston Men first sold their staples in places like Monterey or Yerba Buena Cove, and then set out to collect hides from the ranches of the Santa Clara Valley or Sonoma. In the tradition of merchants throughout history, some of these traders ultimately settled where they bought, so we find an "American" population in California before the Gold Rush. And that American population found California splendid but strange in its nature.

The early trading background of the Bay Area deserves a clear statement, as the adolescence of the region was so precocious that we tend to overlook its normal parentage. San Francisco Bay became one of several score of Yankee trading outposts in the era of sailing ships. The

merchant of that time was a true venturer and sent an agent, or went himself as super-cargo, on a sailing ship to sell and to buy. As this trade became stabilized and seasonally recurrent, through better ships and better sailors, and through the burgeoning productivity of New England factories, it was inevitable that the super-cargo should come ashore.

Thus, well before the Gold Rush, an interest had arisen in finding an entrepôt on the California coast. Behind San Diego there was only desolation, while Los Angeles was isolated from the sea by a harborless coast. Santa Barbara had neither harbor nor effective hinterland. Monterey was better provided for, but was isolated from the large areas of emerging ranches in the Central Valley and was less sheltered than San Francisco Bay. While the government rested in Monterey it could attract merchants, but once administration departed, the town could survive only through specialization as a fishing port. In this, Monterey follows a tradition of supersession of coastal "city state" colonies of classical mold. Commercial colonization starts at the farthest contact of land and sea and progresses to the most intruded of seas. In California the past century has witnessed the shift from Monterey to Sacramento.

The merchant origins of San Francisco help explain the eccentric location of the city itself. Just as there has been an historical shift in the sea-land contact from the outer coast to the inner river during the last hundred years, so too has there been a slow shift in "urban functions" from a concentration in the City of San Francisco to a scattering throughout the Bay Area. Cities in general have experienced such shifts of activities away from the center, but in San Francisco the move started earlier and has progressed farther. These facts necessitate some attention to the peculiarity of the original site.

San Francisco: The Warehouse

The Gold Rush of 1849 made permanent the preliminary urban geography of the hide trade. So long as the trade-ties were carried on largely on shipboard, as Dana observed it in 1834–36, the Bay Area had a commercial organization typical of pioneer America. Carl Bridenbaugh has reminded us that in Colonial times there were very few commercial towns—Boston, Newport, New York, Philadelphia, and Charleston—and that trade with the remainder of the colonies was carried on chiefly by itinerant merchants, the Yankee pedlars.[12] On the eastern seaboard, population growth and the commercialization of agriculture led to the "settlement of trade" in country towns. By 1700, Boston lost the absolute dominance of American trade it formerly enjoyed, but spawned a string of "Boston stores" whose existence as department stores in the Middle West may still be an enigma to those who look only at the present. In the far West, the Yankee pedlars—who were known collectively, whatever their geographic origin, as "Boston Men"—followed an established tradition when they came ashore to set up shops.

When writing in 1849 about Mexican California, Joseph Revere noted that:

> The trade of this country has been mostly monopolized by a few Boston houses, and Boston is better known among the natives of all kinds than any other part of the United States. These houses despatched to their agents assorted cargoes of plain cottons, prints, handkerchiefs, shoes, hats, coarse woollens, hardware, fancy goods, and, in short, specimens of all the cheapest fabrics of Lowell, Lynn, and Marblehead, and a plentiful supply of the auction trash of Boston.[13]

Such goods were sold on "trust" by the merchant who, usually in August after the annual *matanza* (slaughter), exacted his price in hides.

Around San Francisco Bay there were a number of rivals for the honor of being the site of the metropolis even before gold was discovered. But once the yellow metal had been found the fight was in earnest. To understand the ultimate supremacy of what is now San Francisco, we must look at the purpose for such a city. From 1848 to 1869, from the discovery of gold to the completion of the transcontinental railroad, the Bay of San Francisco was the warehouse for the economic life of California. Into that structure poured the mass of goods necessary to support a far from self-sufficient population. So

[12] Carl Bridenbaugh, *Cities in the Wilderness*, New York: Alfred A. Knopf, 1955, p. 182.

[13] Quoted in Warren S. Tryon, *A Mirror For Americans*, Chicago: University of Chicago Press, 1952, vol. III, p. 680.

long as hides had been the primary export, California's population could feed itself, turning to the traders only for textiles, trinkets, and manufactured staples. But the men who came to dig for gold were entrepreneurs, not farmers, so their economic existence depended upon the presence of a warehouse kept filled by full-time merchants.

The goods that were stocked had to come almost entirely by sea. The manufactures came around the Horn from the eastern seaboard or Britain. The foodstuffs came initially from Oregon, from the Mendocino Coast, or from other areas most easily tapped by sea, such as Hawaii or even Australia and Chile. This flow of commodities had to pass through the Golden Gate in order to reach the gold fields. The goods also had to be trans-shipped to vessels appropriate for the inner bays and the Sacramento or San Joaquin rivers.

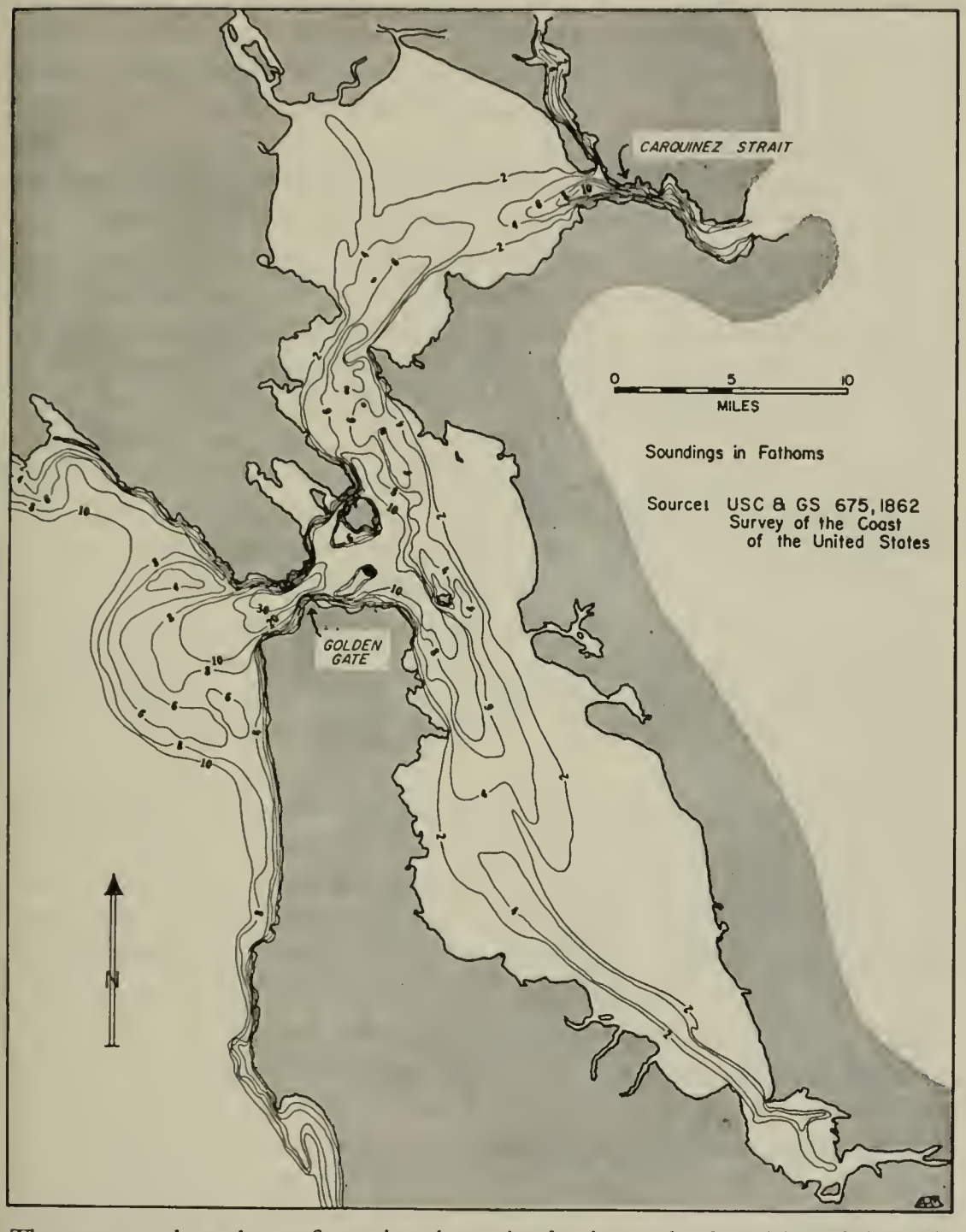
In only a few places did deep water occur naturally in the Bay of San Francisco. Such depths existed in Richardson's Bay, off Sausalito, where William Richardson was granted his ranch north of the Golden Gate in 1838 as a potential provisioning base. But he found that ships tended to veer to starboard when they entered the Gate and to come to anchor in the firm bottom well out in shallow Yerba Buena Cove. For this reason he never moved the "shanty of rough boards" he had set up on the shore of the cove in 1835 and in which he "... was doing a little trading between the vessels and the Indians."[14]

In a water-based transportation system it is advantageous to bring inland navigation as close to the sea as possible. We find this still in such barge-ocean freighter trans-shipment ports as Rotterdam, Rouen, and Antwerp. If cargo must be reloaded for inland navigation, the transfer should take place as near the sea as possible, in order to minimize the need for navigation improvements or pilotage. A glance at the map of water depths in San Francisco Bay shows that specialized local knowledge was essential for navigation there. The inland navigator would have this knowledge, but not the captain from Salem. The youthful clipper captain wanted no more than the first firm anchorage inside the Gate. And it was Yerba Buena Cove.

The function of storehouse for the gold fields—which San Francisco served after 1848—established special site requirements for the town's founders. At Yerba Buena Cove, the first seagoing ship came alongside a wharf in 1848 when the brig *Belfast* docked at Clark's Point at the foot of Broadway. To accomplish this the early citizens had to build rather long wharves across the mudflats of the cove. Deep water was closest inshore where Telegraph Hill dropped into the Bay, giving this

[14] Richard Henry Dana, *Two Years Before the Mast,* New York: Bantam Books, 1959, p. 178.

Map 2: Submarine Contours in San Francisco Bay and Vicinity, 1862



The contours show the configuration that existed prior to the deposition of the main load of silt and mud that came from hydraulic gold mining. The general shallowness of the bays should be noted, as well as the absence of deep water inshore, except off Yerba Buena Cove (already filled in 1862), Point San Pedro in Richmond, and Sausalito and Tiburon.

section an advantage over the rest of the shorefront. At the foot of Pacific Street there was an early wharf, relatively level land inshore, and the potential for a trans-shipping trade. Here, from the earliest days of the gold rush, merchants had warehouses which were stocked from seagoing vessels and emptied by the boats plying the rivers that led to the gold fields.

The descriptions of the town that grew so rapidly in 1849 and 1850 tell of a totally utilitarian place. Henry Wise had noted in 1845 that:

> The site seems badly chosen, for although it reposed in partial shelter, beneath the high bluffs of the coast, yet a great portion of the year it is enveloped in chilling fogs; and invariably, during the afternoon, strong sea breezes are drawn through the straits like a funnel, and playing with fitful violence around the hills, the sand is swept in blinding clouds over the town and the adjacent shores of the bay.[15]

This view was supported by Bayard Taylor who four years later found on arriving at San Francisco that "A furious wind was blowing down through a gap in the hills, filling the streets with clouds of dust."[16]

The hills themselves were austere to Lt. Wise. He found:

> . . . nothing either pleasing or inviting in the landscape in the vicinity of Yerba Buena. All looks bare and sterile from a distance, and on closer inspection, the deep sandy soil is covered with impervious thickets of low thorny undergrowth, with none of the rich green herbage, forest or timber as in Monterey.

Its site held no appeal to its early beholders beyond that of convenience. Here man could debark from ships and board river boats for the "diggings," and here merchants could use hulks or ramshackle warehouses to store goods against the insatiable demands of these miners in the foothills of the Sierra. Neither the town nor its locale was then thought of in other than most mundane terms. It served, if a bit grimly, as a classic entrepôt.

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[15] Tryon, *op. cit.*, p. 667.
[16] *Ibid.*, p. 693.

The Boatman's City

Despite its limitations, San Francisco in the early 1850's was the hub of the most important transportation network on the Pacific Coast. Today we easily overlook the importance of the waterways opened to the world by the Golden Gate. Before the advent of railroads, and in the era when California's maddeningly contrasting climate made the roads impassable for much of the year, the rivers formed the greatest asset to travel. Even before gold was discovered, in 1847 the small Alaskan steamboat *Sitka* was brought to the Bay by William Leidesdorff. And in 1849, the westward trek of humanity was accompanied by a virtual flotilla of steamboats from the Bay of Fundy, the Penobscot, Long Island Sound, the Mississippi, and other sheltered waters.

Before the wheat boom and hydraulic mining of the 1860's and '70's, and before the irrigation of this century, California's rivers were clearer and deeper, making extensive navigation possible in the Central Valley. In the 1850's, during high water, boats ascended the winding San Joaquin River 399 miles from San Francisco to Sycamore in Fresno County. During the time of the Trinity diggings, boats consistently went 250 miles from San Francisco up the Sacramento to Colusa; in high water they reached 395 miles to Red Bluff; and in at least one case managed Redding. The Feather, the American, the Stanislaus, and the Tuolumne all had some navigation. Around San Francisco Bay itself, boats plied to Alviso for San Jose, to a string of sloughs on the bayshore for such places as Union City or Redwood City, and up Petaluma and Napa creeks to the North Bay trading towns. But the main routes were those to Sacramento, for the "northern diggings," and those to Stockton, for the "southern diggings." Even the railroad has not obliterated these two routes, but it has robbed them of most of their élan.

The epitome of river boating was reached when the legendary *Chrysopolis* set a record of five hours and nineteen minutes for the 120 mile run from Sacramento to San Francisco in 1861. And she did this through no sacrifice of utility. Drawing only 4½ feet of water, she displaced 1,050 tons to allow her to carry a thousand passengers and 700 tons of freight. Such large riverboats attest to the importance of inland navigation. San Francisco was the most efficient point of transfer from oceanic shipping to the river boats then used for inland forwarding, and the early merchants' town flowered into a true regional center.

From San Francisco's wharves, boats went regularly—although sometimes with a change to shallower-draught boats in the upper rivers—to a number of "landings" on the parallel streams that flowed across

the Mother Lode Country to enter the Sacramento and San Joaquin rivers. Along with the routes southward to Alviso, bound for San Jose, and northward to Petaluma and Napa, these navigable inland waters provided a network of routes totaling more than a thousand miles in length. Perhaps more important is the fact that all parts of the gold fields, even those on the Trinity, could be reached from landings on this network that were seldom more than fifty miles from the mines. In turn, the mines almost overnight provided an economic base for the water transportation system, and thereby elevated to dominant positions three towns—Sacramento, Stockton, and San Francisco. Sacramento became the reloading point between large, relatively deep-draught steamers on the lower river and the shallow-water boats on the upper Sacramento River and its tributaries. Stockton served as the "port" for the southern "diggings." San Francisco became the point at which this network was attached to the outside world. So long as inland navigation provided the arteries of the gold rush, San Francisco had no rival.

The City Around the Bay

The geographical generality known before 1848 as the Bay of San Francisco gave a name and a location to the town set up to supply the miners. At first, most activity took place in San Francisco itself, perhaps as much due to the requirements of initial convenience, to which we seldom give full weight, as to anything else. But as the Gold Rush became industrial in its nature—demanding specialized machinery, explosives, and stockdealing, among other things—two important shaping forces were added to that of initial convenience.

First, *land-use segregation* began. It is easy to think of this segregation as either the areal pattern created by a negative response to social duty, or as an immutable result of land economics, but neither is an adequate explanation. Land-use segregation is a prerequisite to functional convenience in trade and manufacture under present technology. It takes over in any city given a long enough life and a dynamic enough existence to permit change. The industrialization of gold production supplied both longevity and continuing purpose.

The second shaping force in early San Francisco was *speculation in land.* The settlement of the Atlantic seaboard had taken place under conditions that gave land relatively small speculative value. But when California began to be settled rapidly after 1848, conditions were both unusual with respect to land ownership and ideal for speculation. On the shores of the Bay of San Francisco were a number of large land-grants from the Spanish or Mexican governments to individual land owners. Although there were great contests as to ownership—between the pueblos and the government, between members of Mexican families, and between Mexicans and Americans—we need note only that most of the bayshore was in private ownership. This situation contrasted sharply with the conditions in most other parts of the west where land fell largely into the public domain. Thus, in the Bay Area it was not necessary to satisfy even the none-too-exacting demands of the U. S. government with respect to securing title to land. Squatting, stealing, and other real estate practices made land available for platting, and the conditions of real estate law and practice enhanced the value of speedy sale. To this day, the force of land speculation in the shaping of cities is more easily discernible in California than in most other parts of the United States. In the 1850's getting in on the ground floor was part of the California ethic.

Once the land had been secured by the speculator, either from the ostensible Mexican owner or on occasion from the lawyers whose fees

in land title litigation had "confiscated" the land, the speculator found his return in early sale or lease. Two conditions of the Gold Rush aided the quick ripening of raw land into "building sites." The frantic pace of urbanization in the Bay Area that followed the 1849 rush and the later Comstock Lode boom brought large and frequent additions to the supply of urban land. These increments spread the city out and enhanced the "centrality" of downtown areas in an era of walking or horse-drawn transportation. In classic land-value theory higher land values "result from superior accessibility" to these core sites.[17] The speculator under conditions of very rapid growth thus has two frontiers to attack. These are the two parts of the city where land values would experience the greatest percentage increase in value. He may invest in core land in the belief that the metropolis will grow so rapidly that his profit will come from the rapid appreciation of land values at the center, or he may buy raw land at the edge in the belief that it will quickly be taken into the urban land market.

The second condition of the early boom period that encouraged speculation was the belief in the individual's free choice in the use of resources. The very nature of the California Gold Rush was (1) initially individual, (2) fundamentally non-mercantilist so that any might participate, and (3) fervently ephemeral. The men who operated under this system would logically seek to transform such a permanent resource as land into a commodity, the value of which could be enhanced over a short period. The land market in the Bay Area, which the speculators began, bears out Paul Wendt's reasoning that "inasmuch as land values are based on investor's opinions which in turn are based on expectations, investor psychology is an important influence underlying urban land value trends."[18] Although all land markets in America anticipate an appreciation of land values, the attitude of the investor can influence the time lapse envisioned. In the 1850's *land* in the Bay Area was a commodity to be traded for profit fully as much as it was a site for the metropolis. And commodity profit required an active and speculative market.

Even as the City of San Francisco was founded, land-use segregation had begun. We take as our study region what is now called the "Bay Area," reaching from the southern Santa Clara Valley at Gilroy to the narrowing of the Russian River valley north of Cloverdale in Sonoma County, a distance of almost exactly 150 miles in a NNW-SSE line, and from the Pacific shore inland for some fifty miles. This area includes

[17] National Research Council, Division of Engineering and Industrial Research, Highway Research Board, *Influence of Transportation Changes on Urban Land Uses and Values* (Highway Research Board Bulletin No. 268); by Paul F. Wendt, 1960.

[18] *Ibid.*, p. 3.

all of the valley around San Francisco Bay and the shores of Suisun Bay in the east. San Francisco was one of the area's five mission centers, and the earliest by a single year (1776). Mission Santa Clara came in 1777, Mission San Jose after two decades, Mission San Rafael in 1817, and the last and northernmost Mission, San Francisco Solano (at Sonoma), in 1823. In addition, there were two pueblos, that at San Jose set up in 1777 and standing as the oldest civil town in California, and that at Yerba Buena established in 1835. Sonoma was also a pueblo but was physically tied to a mission. This was the region in which the Bay Area metropolis came into being, and these were the seven drops of settlement which have ultimately grown and come together into an extended city.

Gold in California was both plentiful and lasting. These two characteristics are of importance in accounting for the rapidity of San Francisco's growth to maturity. In much the same way that the California Gold Rush finally made capital relatively plentiful in the United States, it made money available, as if overnight, to set up the city's business structure. More than perhaps any other American city, San Francisco had money to burn, both figuratively and, too frequently, literally. For this reason we can, through a reconstruction of the downtown area's first two years, see most of the fundamental evolution of the business district. And that evolution was shaped by the two forces we have noted—segregation of land uses and land speculation—and was anchored in space to the waterfront that still served to replenish the city's warehouses and carry away its sales.

The Warehouse for the Diggings

The initial business sites were near Grant Avenue, then vaguely "Calle de la Fundacion," and Clay Street where William Richardson and Jacob Leese came to rest on what is approximately the south side of present-day Portsmouth Square. In 1841 the Hudson's Bay Company established what might be thought of as a primordial department store, on Montgomery Street between Sacramento and Clay streets. There soon was dissatisfaction with the site Leese had chosen on present-day Grant Avenue, several blocks away from the shore and on a fairly steep hill. In short order, he and others moved to the beach that then ran along Montgomery Street, bringing about the first of many shifts in focus of the business district. Already implanted, however, were certain structures and ownership lines that gave the city its first determinate points. What is now the alignment of Clay Street was then approximately set out by the track between the beach and the hill. The fact that the beach has been covered over and the hill has long since been

surmounted is unimportant in this context. Clay Street ran more or less at right angles to a beach along Montgomery Street. The two provided what might be called the x- and y-coordinates for the grid system of most of downtown San Francisco. The fact that the original store sites were casually chosen does not detract from their rôle as the city's genesis and *anchor*.

The first instance of land use segregation occurred when the business community moved down off Clay Street hill. Two elements developed very early in the history of the business community. The "wholesale merchants," on reaching Montgomery Street must, at least metaphorically, have turned north, setting up a wholesaling district adjacent to the earliest wharves, those at the foot of Broadway, Pacific, Jackson and Washington streets. First in hulks of ships tied up along the wharves or in shanties, later in true buildings some of which still stand in their original use near Jackson Square,[19] these merchants took in goods from the sailing vessels and subsequently dispatched them to the "diggings" by river steamer.

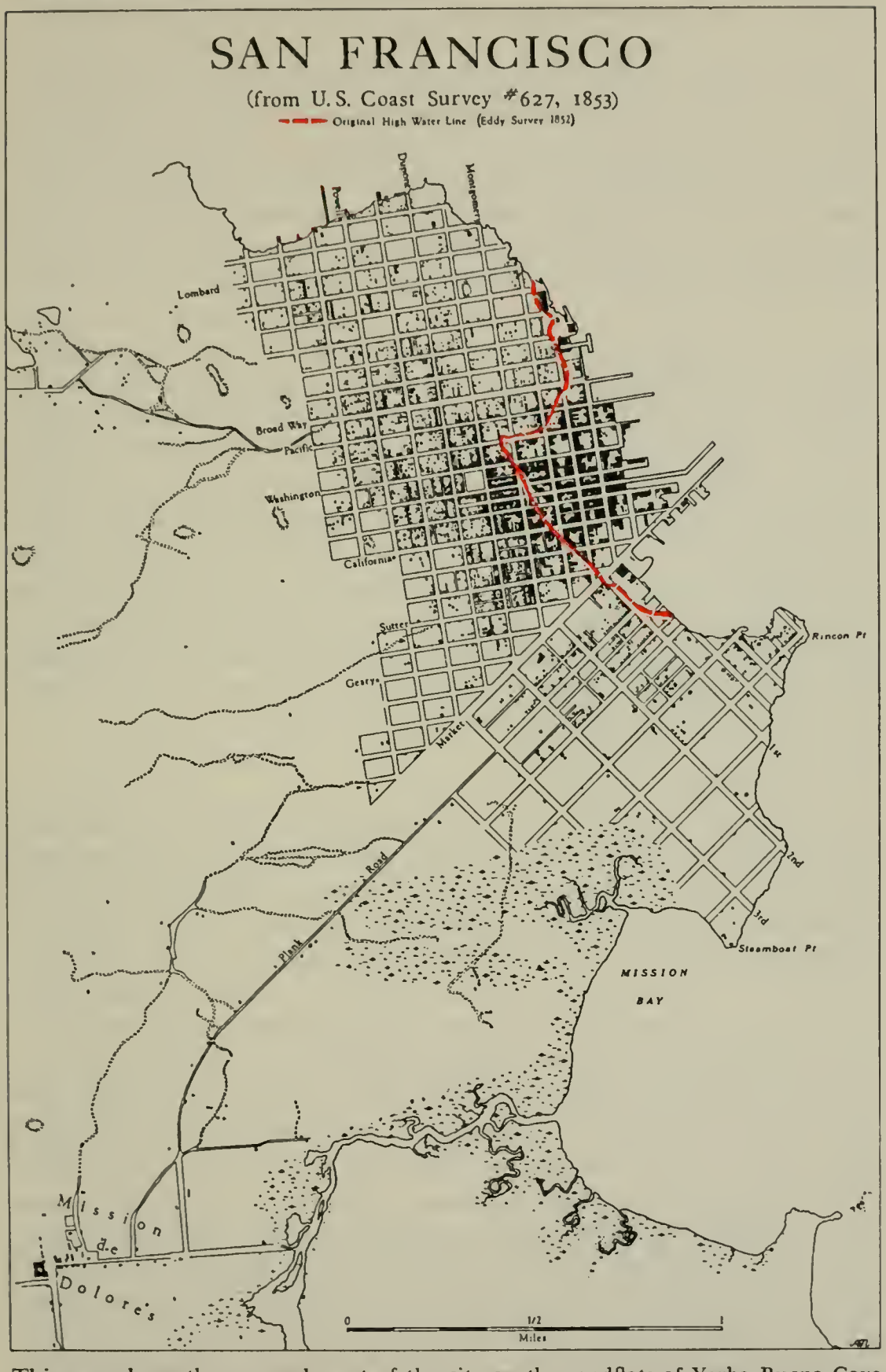
The Financial District

Behind the wholesalers came the dealers in intangibles—mine expectations, land titles, capital, and credit. At the intersection they turned south, selecting as their realm Montgomery Street for the several blocks leading to Market Street. At first they tended to carry on their trade in intangibles above first-floor shops that sold goods to the local people. But as the local population increased and the scale of legal and financial operations grew even more rapidly, a second land-use segregation took place. Prosperity gave the banks much of the ground floor, and the stores had to move to larger premises west of the new "financial district." By then the stock exchange, with its medieval transportation system of runners and the like, was in existence, and the need for sharp exclusion of non-financial uses in the district was obvious. By then, also, the department store had been developed and a separate retailing district was needed.

In this regard, San Francisco experienced a form of office development that is unusual in cities: it soon had a true financial district with the structural connotations of such an area. Only Boston, New York, and Philadelphia had such a specialized district in 1850, although Chicago and Dallas each acquired one later on. The reason San Francisco had a financial district probably relates to the early introduction of a stock

[19] The term "Jackson Square" has come to be applied to an area of wholesale interior decoration establishments on Jackson Street between Sansome and Montgomery streets. The buildings here referred to lie in the block adjacent to the southern side of Jackson Square and mainly on Montgomery Street.

Map 3: San Francisco: The Entrepôt for the Gold Fields, 1853



This map shows the encroachment of the city on the mudflats of Yerba Buena Cove below the original high water line, and the virtual isolation of the trading town from land. Except for the "Plank Road" across the marsh at the head of Mission Bay, the city was framed by marsh, steep hills, or sand-dunes. It was along the wharves extending the streets to deep water that San Francisco made its contact with "the world" and "the diggings."

market there. Because of the industrialization of mining, first in the Mother Lode and later in Comstock Lode, there was an early introduction of stock trading, necessitating the establishment of an exchange. Under the conditions of communication that existed in the 1860's, and because of the highly specialized nature of mining stock exchanges, it was practicable to handle shares only fairly near the mining area. In San Francisco it was possible to judge with at least crude measures the profitability of individual mines; this would have been too risky in New York or Boston.

Once the exchange was set up in the Montgomery Block at Montgomery and Washington streets, it was almost predetermined that the form of city circulation characteristic of seventeenth century London should come into being.[20] The seventeenth century coffee-house business structure, typical of the face-to-face trading of stocks and commodities, came to San Francisco and has persisted to the present. The work of Donald Foley and others has brought out clearly the fact that the sort of business activity that normally is carried on in an area whose omnibus name is "financial district" must have the personal contacts, the sort of closely-knit structure that permits *ad hoc* "business deals," and, perhaps, the conferral of a sense of "belonging" that comes from physical proximity to those at the core of any power elite.[21]

The Wholesaling Districts

After they were set up at the wharfheads so as to trans-ship goods, the wholesale trading activities of San Francisco experienced an early internal division. Trade in perishable goods tended to stick to the wharfhead location, while the activities of wholesalers whose goods could be stocked for some time, and whose trade practices called for the salesman to visit the customer rather than the customer to come to the wholesaler, were shifted to the area south of Market Street by the 1870's. The result was the creation of the produce district east of Sansome Street —which was only replaced in 1963, and then mainly by fiat—and the general wholesale district between China Basin and Mission Street. The produce district grew mainly by encroachment on the shallow

[20] The exchange set up in the Montgomery Block was of the informal sort typical of the beginnings of most trading organizations. In London, the exchange began in coffee houses; and the Board of Trade (Grain Exchange) in Chicago had to provide free "crackers, cheese, and ale" for several years after it was organized in 1850 in order to encourage traders to use the exchange. The bank exchange in the Montgomery Block was in truth a saloon, but it served as a trading place for brokers. In 1863 the San Francisco Stock and Exchange Board was established in offices at Montgomery and Washington streets.

[21] California, University, Institute of Business and Economic Research, Real Estate Research Program, *The Suburbanization of Administrative Offices in the San Francisco Bay Area* (Research Report No. 10); by Donald L. Foley, 1957.

depths of Yerba Buena Cove, and the wholesale district by the filling of Mission Bay.

Even today we can identify these districts. North of Clay Street on Montgomery Street the financial district disappears in favor of a single type of wholesaling in expensive house furnishings. To the south of that intersection, the financial district comes clearly into existence within the first block, continuing almost unalloyed to the intersection of Market Street, where a second sharp break introduces the shopping district which early extended southwestward along Market Street and westward on Sutter, Post, and Geary streets.

Bordering this ultimately tri-partite business district were early residential areas. Dupont Avenue, now Grant, was first a French quarter. Almost immediately it was yielded to the Chinese. South of Market Street there was a brief attempt to build high-class residences around South Park, which was established on Rincon Hill in 1852. There, for example, an already very wealthy George Hearst set up a household for his only son when he was born in 1863, but their stay was short. Although remnants of this South Park development survive, as do oddments of housing on alleys in the center of the large blocks south of Market Street, the whole area quickly became a warehousing and industrial district, as its first plat intended. In fact we find today a strong concentration on Rincon Hill of the larger buildings given over to wholesaling. The fact that the "South-of-Market" area proved to have poor bearing capacity during the 1906 earthquake seems to have caused firms wishing large buildings to construct these on the bedrock that forms Rincon Hill. That bedrock also serves as the west anchor of the Bay Bridge whose vast bulk tends to hide the hill and obscure its staunch height. North of Broadway, around the then unfilled cove west of North Point, more industry grew up along what was called North Beach.

The Southern Pacific (San Francisco and San Jose Railroad Co.) provided street-running rail connections for the wholesaling-light manufacturing district south of Howard Street after the line to San Jose opened in 1864. At first the passenger terminus was at 18th and Valencia streets but in 1889 the present site at Third and Townsend streets came into use.[22] The newer wholesale establishments spread southwestward toward the railroad's graceless dun-colored terminus in the city, which was put up in 1914 to impress the Exposition visitors of 1915. While most American communities sought the grandeur of Caesar or Victoria in their railroad stations, San Francisco, by painting its depot the color

[22] Actually the general tract still occupied by the railroad around Third and Townsend streets came into use as freight and passenger yards in 1872. The passenger station was built on its present site in 1889 and was reconstructed in 1914.

of its section hand's houses, made the terminal so banal that it never even momentarily rivaled the boastful Ferry Building, designed in 1894 and completed in 1898. That Renaissance palace replaced a wood-sided building built at the foot of Market Street in 1875 when the Davis Street Wharf ceased to serve ferries to the East Bay. The central ferry structure at the foot of Market Street gave the city the focus it had lacked since abandoning Portsmouth Square in the first blush of the Gold Rush. While all of this shifting of scenes in the central business district was going on, a centrifugal operation spun the less people-oriented businesses outward away from the central focus.

The District Called Market Street

Market Street held an ambivalent place in this development. It was then, as now, much too wide for a properly functioning shopping street, but at the same time, it was not adequate to carry a large share of the city's internal movement until it was opened to the west through the Twin Peaks Tunnel in 1918. Market Street provided the base for numbering other streets, and the oblique intersections created chaos in the system. The alignment of Market Street was independent of the early grid, representing a line between Yerba Buena Cove and the Mission. Few streets have ever had so many intersections and so few crossings. Nonetheless, San Francisco tended to come together on Market Street, using the broad roadway to open the sites for buildings whose monumentality must be seen from afar. In this, and as a place to walk and crowd together, Market Street served *locum tenens* for the downtown park San Francisco so badly needed but largely lacked.

Few cities have doted on beauty to the degree that San Francisco has on the pretensions of this wide but unlovely street. Without important external connections until the Ferry Building and the Twin Peaks tunnel were built, Market Street still dominated the city's core. Along the northerly side of the street the local commercial banks set up shop in what remain to this day buildings that challenge as much as they reassure. The Crocker Building is clothed in a toga, while the Wells Fargo Building stands in a tunic, but neither accepts the scale or structural system of the prototype. Neither is a true-believer in any system. To this day, the street remains one without clichés. In that fact, rather than in any first-class design, we find Market Street's strength. Other cities have far better integrated "cityscapes" but few have streets with the impact of patent *urbanity* that the breadth and bragging of Market Street afford.

As the retailing area moved west of the Market Street-Montgomery Street intersection, it developed subsections whose individuality has

increased over the years. Along Market Street, beyond the shops, commercial recreation took over, creating a diverse district appealing to those for whom a city must be bright and straight-forward—to sailors, soldiers, and other men whose designation is always generic. Without pursuing its erratic and sometimes unfettered course, we may note that this quadrant of the city's core has tended to absorb the elements of city life that remain outside the idealized view of San Francisco. Here on Third and Fourth streets and Howard and Mission streets is the skid-road that is a functional necessity in any Western city. And along Eddy and Ellis streets, small hotels and rooming houses have come to house those people who refuse to accept the stigmata of "senior citizen" or "unemployable" that would be pinned on them in the more personalized milieu of the suburb.

To complete the transformation of "The Tenderloin" from a red-light district into a district of "loners," alcoholics, and petty pensioners, it has been necessary to spin off the recreational activities of those people who make up the body of society and whose social aspirations are thought of as normal. Although North Beach and its fringes toward the financial district is today, at best, a pseudo-bohemia, it still serves the whole of Bay Area society. The old commercial recreation district along Market Street has become largely the haunt of the declassé, of soldiers and sailors and transients *sans place*. It is San Francisco's tithe to unrooted life and aspirations.

The Land of Hope

Sharply contrasting with the declassé area southwest of Union Square is the sector to the north and west, where the most accepted aspirations of the Bay Area reside. In slightly larger and somewhat newer buildings, whose neighbors are the high-class apartment houses of Nob and Russian hills rather than the railroad station and bus depots, the young and aspiring of San Francisco live. This sector is convenient to the workplaces dictated for those who wish to rise in such a materialist society as that of the Bay Area, and it is physically neater and quieter than North Beach.

This home of the somber-suited and striving is bordered on the south by the most acceptable face of the commercial recreational area—the theatre district along Geary Street—which successfully masks an unconformity in the pattern of social geography. On the west, the district abuts another commercial street, Van Ness Avenue, whose automobile showrooms disguise another social unconformity: that between a population rising in business and professions living to the east, and the sidetracked society of the Negro district to the west. On the north,

the district peopled by the hopeful merges physically into the homes of the wealthy and powerful they seek to become, the latter perching on the high ground running from Nob Hill westward to Sea Cliff. These are summary designations with the attendant over-sharp "focus" which comes from the need for initial clarity in any working hypothesis. This hypothetical structure for the social geography of San Francisco's core must wait for more complete examination and analysis at a later date.

The Emerging Specialty Shop

American cities have always expanded in directions that the wealthy and powerful have pioneered. San Francisco is no exception. As the retailing area grew, its focus moved slowly westward and northwestward toward Nob and Russian hills. The hills themselves have been avoided as demonstrably impossible sites for shops. But the vector of movement has been in that direction. From an initial focus on Market Street just west of the intersection with Montgomery Street, the retailing district has shifted northwestward. Today, its focus is Union Square. Although mass shopping establishments still cluster at Market and Powell streets, there seems little question that Union Square has already become the functioning center for specialty shopping, the type most likely to remain in the central city. On the square's south side, the larger specialty shops have come into being; and on its north and east side, the smaller or less clothing-oriented shops are found. There seems to be relatively small growth in San Francisco's central shopping area. If any trend is discernible, it is perhaps better described as "consolidation" into a specialty district of shops formerly spread around the business district or only recently opened as branches in San Francisco. The specialty district may show no strong signs of encroachment on the better residential area, but it does show a close juxtaposition thereto.

Housing the Worker

The segregation of land uses in the heart of San Francisco has continued down to the present, creating a number of subdivisions whose individuality supports the view that this is a city center given over in large measure to specialty uses. Martyn Bowden has found that San Francisco was a city of parts from the very beginning.[23] The Mexican focus beginning in 1835 at what is now Portsmouth Square was medieval in its land-use, but the Gold Rush city was re-shaped in the modern image. Small size and a cultural tradition of the best families living at

[23] Martyn J. Bowden, forthcoming Ph.D. thesis on "An Historical Geographic Concept of the San Francisco Central Business District 1850–1963," submitted to the Department of Geography, University of California, Berkeley.

the center probably encouraged the mixing of activities around the plaza. With the development after 1848 of the trader's city, adjacent to the wharves that both brought and forwarded miners and their goods, land there was too unique a commodity to be used for housing in a culture whose leaders did not think their houses must front on the square. Those leaders shared a class ideal of an exclusive address, and that was obviously an impossible goal at the commercial center. They found it first on Rincon Hill (up to the early 1860's) and later on Nob Hill, in areas where terrain allowed them exclusiveness at a cut price, keeping the shops and warehouses out through terrain rather than by economic barriers. But in the seventies the nabobs did have to pay part of the price when they built the California Street cable-car line in order to reach their homes without apoplexy.

The people lived around the several areas where jobs were found. Men at first walked to work from the early housing areas near North Beach and Yerba Buena Cove. By 1857 some came by horsecar from farther west in the Mission District. Bion Arnold's map of street railways operating in San Francisco shows that by 1864-65 there were horsecar lines from both North Beach and the Mission District to the downtown area.[24] But Nob and Russian hills were left as heights that could be reached only by carriage. The ownership of private vehicles stratified residence in a very literal sense.

Later, when there were no more heights to conquer, San Francisco society had to practice horizontal mobility. Although never enjoying the cachet of Nob Hill, Russian Hill and Pacific Heights allowed a reasonable expansion of the supply of fashionable land with a commanding view of the city. In the 1930's Homer Hoyt noted as typical the residential spread of such sectors as these, the original social status being carried radially into newly developing land. In San Francisco this condition is well shown, but probably more for physiographic than social reasons. Starting on Nob Hill, after several false starts, fashionable land expanded, as we have seen, until it arrived at Sea Cliff. Perhaps symptomatic of the finality of such social judgments is the naming of the western terminus of this march, Land's End.

The rest of the workers followed basically similar trends in the choice of residence, if with somewhat reduced preemptive rights. The inner Mission District and Western Addition followed logically, beginning to be taken up in the late 1850's. The heights to the south, Potrero Hill in particular, served to house many people a decade later. The use of hillsites by people in modest circumstances may need some

[24] Bion Arnold, *Report on Transportation Facilities, City of San Francisco,* San Francisco: Bion Arnold, the author, 1913, p. 413.

explanation, as the hills in question reach elevations similar to those in the Nob Hill-Land's End alignment. But the downcast eye from the former viewed industry and warehouses, and subsequently, the grubby and unkempt Southern Pacific Railroad land, rather than the halls of commerce and finance.

Factories Follow the Market

In the 1850's the city began to make things for the mining concerns being set up in the Mother Lode. The requirements of the mines fell logically into three categories: explosives to break the ore out; machines to crush, stamp, and concentrate the ore; and smelting plants. The mine and mill supply factories made up San Francisco's first industry. From the Presidio on the west they were strung out along the shore to the working port south of Telegraph Hill. Bulky and dangerous products were made in this band where access to the inland navigation system was good.

As might be expected, once industry came to San Francisco it sought sites rather different in nature from those used by the early merchants. One of the first plants might almost be taken for granted, that of the Donahues at Mission and First streets in 1851 (Union Shovel Works). This concern proved a bellwether of San Francisco industry, being the first of a flock of mining machinery and equipment factories that made the city the world center of this trade by 1875. Long after the California Gold Rush had slowed to a plodding pace, San Francisco continued to supply the capital goods for expansion of mining in Australia and South Africa.

Along the waterfront, particularly in the section south of Market Street, shops were set up to undertake ship repairs and even the production of marine supplies. From these locations it is obvious the manufacturers were not concerned with access to general shipping facilities, as in the case of the produce district, or with internal convenience, as with the financial district. If the manufacturers were subject to a controlling force, it was the need for access to the wharves to obtain raw materials. This requirement did not demand a location where scheduled steamers docked, so much as access to quays where ships bringing raw materials from the East and Australia could tie up. The plants were situated on relatively flat terrain, preferably on firm rather than filled land. Obviously such generalizations apply most specifically to the larger and the heavier industries, and much less to the coffee roasters or needle trades which have continued to cluster around the lower end of Mission Street even up to our day.

The industrial areas did, however, soon outgrow this cradle. The experience with powder factories was explosive, in a very literal sense. As a result, the deep but narrow valleys of small tributaries of San Pablo Bay in Contra Costa County came into use by the powder companies. In the new location they managed to separate the several operations of explosives manufacture. Another example of fledglings leaving the nest came with the move, in 1885, of the Selby smelter and cartridge factory from Harbor View near Fort Mason in San Francisco to an isolated point on the Contra Costa shoreline. Even there, trouble arose over the fumes from the smelter, but ultimately a 605-foot chimney quieted most objections. Less a product of neighborhood squabbles was the move of the foundries from the shore-belt in San Francisco to more roomy sites near Hunter's Point, and to Oakland.

Although mining machinery was the "seed industry" for San Francisco in metal fabrication, the making of agricultural machinery began early and became very important with the big development of "industrial agriculture" in the 1870's and 1880's. Wheat to begin with, and later fruit growing for drying, canning, and for wine, led to a demand for specialized machinery that could not easily be brought from the East. The agricultural machines tended to be devised and first fabricated near the fields where they were used. This introduced a force leading to the location of these newer metal working industries away from San Francisco. We see this in the making of food machinery in San Jose, which sprang from the introduction of spray pump manufacturing in Los Gatos in 1883. The East Bay area also produced much agricultural machinery.

In the 1860's the development of shipbuilding in the Bay Area created a demand for marine engines and specialized metals that was first met with imported steel, but that was supplied from steel plants at Pittsburg and South San Francisco by 1910. In an industrial sense, these plants closed the circle of development. Starting from a small base of industry located in San Francisco and using imported iron and steel to fabricate specialized products for the local extractive and agricultural industries, the Bay Area had become a general manufacturer whose steel was locally produced,[25] but whose product was still largely confined to the California market. Thus, one further step, that of selling to a national market, had yet to be made at the turn of the century in order to create a full-fledged industrial area.

[25] Although the steel was locally produced, the pig iron was brought from Geneva, Utah, to Pittsburg, California, for conversion into steel. Even steel production was temporarily suspended at Pittsburg in the spring of 1964.

The Influence of the Fog

The history of housing development in the Bay Area is intimately related to the persistence of fog during the summer months. Thus no picture of the growth of San Francisco housing would be intelligible without a discussion of the fog and its occurrence. Meteorologists tell us this phenomenon is normally low stratus cloud rather than fog, but for the house buyer the distinction is idle pedantry. The fog's causes are open to some dispute, but it appears to depend most fundamentally upon the existence of a strong atmospheric inversion throughout much of the summer in the latitudes of the California coast. The inversion is caused by a wedge of cool air coming off the chilly sea in summer[26] which pushes in under the warmer air lying over the land and produces a thin surface fog to begin with. As the wedge of cool air thickens, the inversion rises and the fog deepens. Within the cool air wedge there is overturning of the surface layer of air, but the relatively shallow depth of cool air below the inversion restricts the size that the droplets of water may attain while rising through the lower air. The minute droplets forming just below the inversion layer give us the "cloud deck" or high fog that shrouds part of the Bay Area during much of the summer.

Thus, during the summer the air that flows from the ocean inland toward the Central Valley has two strongly developed characteristics. (1) It is relatively cool for the latitude, having passed over the band of cold ocean water before invading the gaps in the rampart of coastal mountains. (2) It cannot develop any great depth of convectional overturning because of the inversion layer noted above. Under these conditions the fog rolls into the Bay Area, and its pattern of movement is largely controlled by the gaps in the mountain wall. Where the heights near the ocean reach through the inversion layer, the fog is stopped, leaving in the leeward fog-free areas protected by ridges such as Montara Mountain or Mount Tamalpais. Other unprotected sections —such as the Berkeley Hills that face the ocean through the gap of the Golden Gate—are shrouded in fog. This contrast between protection and exposure to the sea explains much of the difference in the persistence of fog in various parts of the Bay Area. Where there is exposure, the greatest occurrence of fog will come at the level where cloud deck and hillside meet over the longest period.[27]

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[26] Off the coast, the persistent northwest winds of summer cause a seaward drift of moderately warm surface water. This permits the colder middle-level water to well up, presenting a cold sea surface adjacent to the land, and cooling the in-blowing air.

[27] For a fine and detailed discussion of the "fogs" of the Bay Area see Harold Gilliam, *Weather of the Bay Area,* Berkeley: University of California Press, 1962.

If we may understand the coastal fog on the basis of an unusual assemblage of meteorological conditions, we must explain its distribution within the Bay Area on the basis of terrain. This region is one of very sharply contrasting elevations—of large flat-floored valleys and sharp, relatively high and basically continuous ridges. The Golden Gate is the lowest gap in the coastal rampart, although other openings exist (1) south of Twin Peaks in San Francisco, (2) in the valley south of San Bruno Mountain in Daly City and Colma, and (3) across low ridges in the coastal portions of Marin and Sonoma counties in the vicinity of Bodega Bay. Because of the location of the cold area north of the Golden Gate and the general wind direction, fog is most likely to come through the Golden Gate or the other gaps in San Francisco. But even within the city, a location in the lee of a hill-mass affords some relief from fog.

In his study of Bay Area summer climate, Clyde Patton has demonstrated several characteristics of these fogs that are important to a discussion of housing location.[28] From his map we see that the increase in the height of hills north or south of the Golden Gate cuts down the inflow of air that has been in contact with the cold sea surface. In other words, the air that moves across the Marin hills or the Santa Cruz Mountains comes from a level higher up in the column of air and has not been in contact with the water surface.

From Patton's map we see that much of the Bay Area valley is filled with fog during the very early morning, but only near the open door of the Golden Gate is fog common throughout the day in the summer. Absolute elevation is of considerable importance for two reasons. The first is that not all the fog occurs at sea level. At times the fog blanket may lie several hundred feet in the air, so that it comes in contact with the earth's surface on hillsides rather than at sea level. Second, air that may not have been cooled quite to the point of condensation while moving across the area of cold sea surface will experience additional cooling when forced to rise over hills. This is true of air moving upward over the outer coast range, explaining the "combers" that often peep over the top of the Santa Cruz Mountains during the summer. In the East Bay Hills this condition is improbable, except opposite the San Francisco gaps, because elsewhere the coastal rampart has tended to stop any great inflow of air. The amount of fog that strikes any one point during the summer is thus a function of (1) its exposure to air from the sea, and (2) its relative elevation.

In the city itself early settlement avoided the land west of the spine

[28] Clyde P. Patton, "Climatology of Summer Fogs in the San Francisco Bay Area," *University of California Publications in Geography*, 10(3):113–200, 1956.

Map 4: Early Morning Stratus Cloud

This map shows the percentage of observations made at various places in the Bay Area in June, July, and August, 1952 that found a stratus cloud cover at 2.30 A.M. The widespread occurrence of stratus cloud—the normal Bay Area "fog"—over the ocean, San Francisco, and the East Bay Area from Berkeley to the southern end of the Bay is striking. (After Patton)

of hills that comes to an end at the Presidio. Even as late as Bion Arnold's map of population distribution in San Francisco in 1913 there was little housing west of the hills. Only in the Richmond district, in the alignment from Nob Hill to Land's End, were there many houses, although the low saddle along Oak Street leading to Golden Gate Park was pretty well filled by the westward growth of the residential area in Hayes Valley. The houses in the Richmond district were located in an area where cable and electric lines had been built in the nineties.

The tule or radiation fog that lies in the valley bottoms east of the Berkeley Hills in periods of still air during the winter, seems to have had less influence on housing development than has the sea fog. This radiation fog forms in the Central Valley's moist low areas—called "tules" after the Spanish-Indian name for the bulrushes growing there —and drifts into the valleys enclosed within the several inner chains of the Coast Ranges. So long as air remains still and the fog is thick enough to reduce the amount of solar heat reaching the land surface, radiation tends to continue from the cooling surface. This chills the layer of air in contact with the earth's surface and maintains the fog, or expands it.

Because of the draining of colder (denser) air from the hillsides into the valleys, such as those in eastern Contra Costa County, the tule fog may increase during the night, only to evaporate in its thinner parts, on the hill slopes, during the day. Thus, the valley bottoms are damper and foggier than the slopes during the day. This situation is, however, common to most areas in the United States, so it does not stand as an idiographic element as does the incursion of sea fog in the Bay Area. Man in this area may avoid foggy bottoms as he does everywhere, but only in the Bay Area need he also shun the breaches in the wall of coastal hills on account of the fog they let through.

Map 5: Mid-Afternoon Stratus Cloud

This map brings out the geographically restricted occurrence of stratus cloud ("fog") in mid-afternoon (at 4:30 P.M.). In general the control for cloud distribution is the "gap" through the coastal mountain wall at the Golden Gate. This makes Berkeley and San Francisco "foggy" but leaves clear the other areas that are protected by the hills and mountains. (After Patton)

The City of Parts: A Large-Scale Venice of the West

The enduring physical pattern of the Bay Area was set in the first decade after the Gold Rush. As we have noted, land-use segregation and land speculation shaped the frame on which the subsequent city has grown. These two forces were joined by a third, *changes in transportation technology*. Collectively they account for the physique of the city today.

In San Francisco itself these forces are clearly shown. The speculative value of land—which in early San Francisco must be defined as any area too shallow to sail a freighter across—led to the rapid sale at high prices of lots on the mud flats east of Montgomery Street. Similar speculative anticipation supplied capital to breach the wall of sand dunes that at first cut off Market Street to the west of Kearney Street. Speculative pressures quickly led to the filling of the shallow flats east of Montgomery Street and off North Beach to make more land.

These anticipations were also of major importance in the establishment of internal transportation. In 1850, a plank road was laid across the marshy bits to Mission Dolores. But the building of horsecar lines was even more directly a promotional activity. Enhanced land values were expected to result from the building of lines to the Mission District, thus providing the promoters a profit. A none-too-propitious site —windy, sandy, and scrub-covered, with a port consisting mostly of mud-flats, and a girdle of surrounding hills and marshes that basically isolated the townsite—was thus made into a city through the investment of considerable sums of money. In this way the *site* was made viable. The history of the succeeding century has been one of truly phenomenal investment to render the *situation* of San Francisco somewhat less inimical to city-functioning than nature had made it.

Several early visitors to San Francisco saw it as a "Venice" on the edge of Western culture. The encroachment of the city onto the mud flats of Yerba Buena Cove took place on wharves built seaward in the alignment of the main streets that O'Farrell had laid out in 1847. These were then connected one with another by plank walkways of what have since become such streets as Battery, Front, or Davis. But this is Venice in reverse, with the thoroughfares raised above the water and the intervening space left awash. Rather more apt would have been the analogy between the local transport on the Bay and that at the head of the Adriatic. In both places the city was effectively isolated save for

water connections. San Francisco had ferry connections at an early date—Whitehall boats at first and then steam ferries. Because the city's history is, in the strict sense, post-industrial, steamboats existed from the beginning and the economic organization of the Bay Area called them into wide use.

Partly because of its difficult and eccentric site, when San Francisco expanded at the time of the Gold Rush, a water-connected diaspora was easier to establish than outliers tied by road. Oakland, Alameda, San Leandro, and Union City in Alameda County, Alviso in Santa Clara County, Redwood City in San Mateo County, Sausalito and San Rafael in Marin County, Petaluma and Sonoma in Sonoma County, Napa in its own county, Vallejo, Benicia, and Suisun in Solano County, and Port Costa, Martinez, New York of the Pacific (Pittsburg), and Antioch in Contra Costa County all fell in this class of minor ports tied to San Francisco largely by water transport. The very prevalence in the Bay Area of roads called the "Embarcadero" tells us in most cases (a few being no more than twentieth century shams) there was alighting and embarking at those places in the "Venetian" era. Some of these river and bay towns were strictly collecting points for local produce to be forwarded to San Francisco. Certainly Petaluma and Napa were strongly of this nature. Other landings, such as at Alviso and Oakland, were more in the nature of ferry terminals. Benicia and Mare Island very early became government "industrial" establishments, with the first Pacific coast naval shipyard in the latter (1854) and the first arsenal in the former (1851). But both, irrespective of service affinity, were on navigable water.

Thus the oldest settlements in the Bay Area were on "embarcaderos," and the skeleton on which the latter-day metropolis grew already was determined in the early days of settlement by the United States. Even today the spread of urban growth has not surged significantly beyond the limits of local water transport of the 1850's, except for quite recent growth between Walnut Creek and Dublin. But the Venetian era was one of primordial transportation. The embarcaderos were little more than just that, a place to get on or off. The forces of speculation and land-use segregation had to come into play before the metropolis grew to reach, in continuous built-up area, these landing places that served to tie the peninsular entrepôt to its landward customers.

The presence of a water body permitting the near-instantaneous creation of a regional transportation system was fundamental to the development of the Bay Area. Within five years, the San Francisco settlements expanded over an area greater in size than the state of Connecticut. By contrast the Massachusetts Bay colony moved its

settlement frontier inland only twenty-five miles in its first half-century. Granted, Massachusetts had outlying settlements at Worcester, Brookfield, and in the Connecticut Valley, but those places were not tied to the settlement core by the intimate contacts that united the Bay Area landings even in the first years.

The San Francisco Bay Area was, from the beginning, characterized by *an open extensive settlement pattern* with a few major nuclei, such as Petaluma, Sonoma, Napa, or Fairfield, and with large areas of intervening space. Spreading the population "thin" and carrying them about on water, the Bay Area metropolis was able to stake out the limits of its ultimate site, even by the mid-point of the nineteenth century. Subsequent events have merely filled in this initial frame.

Steam Comes Ashore

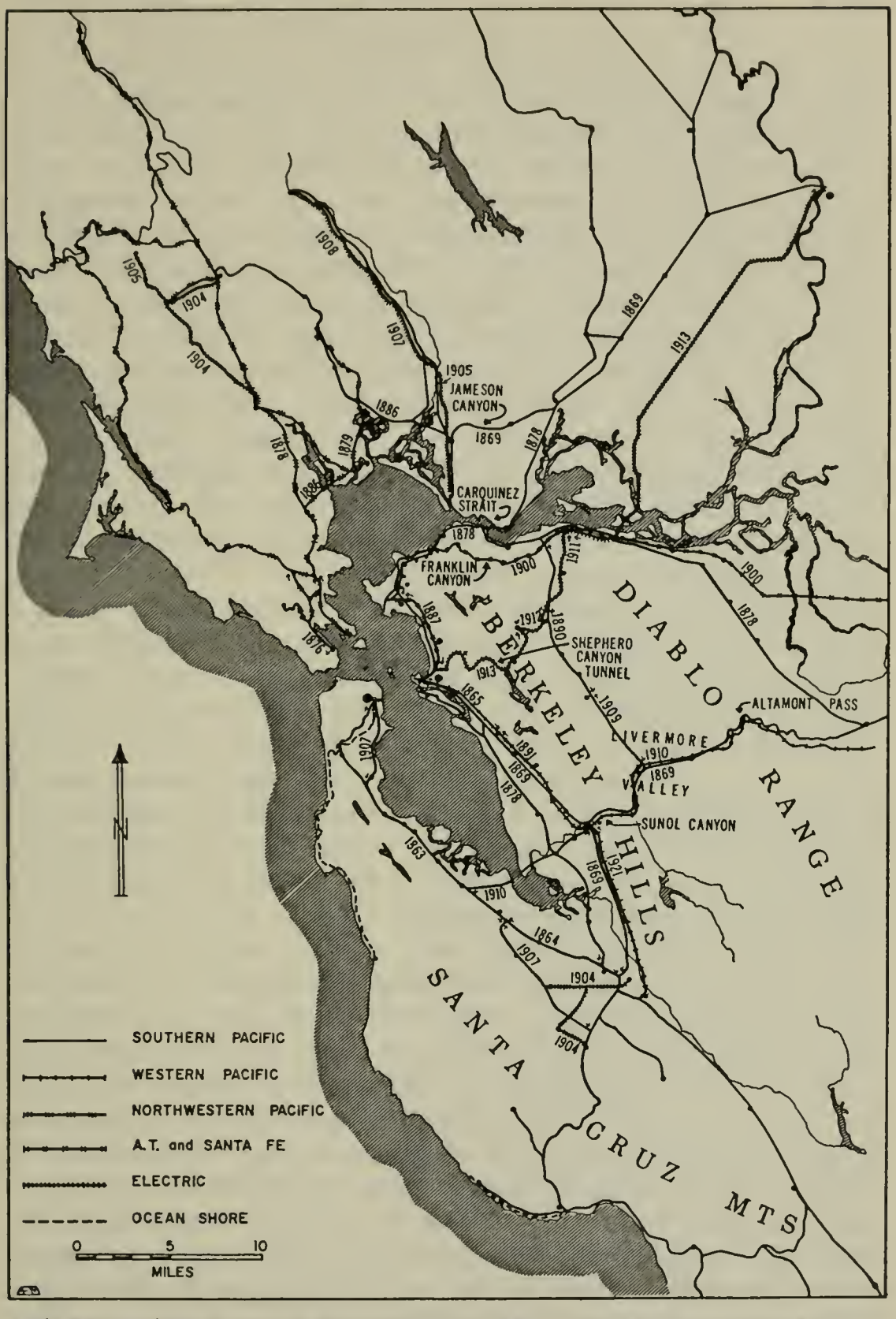
The Venetian pattern of settlement continued as long as mechanical transportation was limited to water. In a few cases, such as on the San Francisco Peninsula, a small amount of ex-urban housing could be reached by road. More common was the country house reached by water, as in Alameda after it was founded in 1853. Country residence was certainly possible in the case of those individuals whose support did not depend on regular work in the city. But the ties continued to be by water, for the most part, because the relative efficiency of the steamboat over the horse-drawn carriage was very great. Even at this time, there were paddle-boats capable of speeds of 15 to 20 miles per hour.

As the economy of the Bay Area settled down, developing the wheat as well as the gold-fields, the trans-shipment of goods necessitated by the river traffic worked against San Francisco's prosperity. Wheat growing diversified the economic base of northern California, and with this activity came the demand for good land transportation. San Francisco found itself in a strange position when agitation began for railroads in California. One of the first proposals was the building of a line southward out of the city to San Jose, where connection would be made eastward to the Central Valley and, by implication, from there to the East.

There were only three practicable entrances from the east into the valley around the Bay. In the north, Jameson Canyon west of Fairfield was low and open through the innermost coast range. Farther south Carquinez Strait afforded a practicable, if costly, gap through the ranges. And finally, in southern Alameda County, the combination of the low crest in the inner range at Altamont Pass, and Sunol Canyon, cut by Alameda Creek through the Berkeley Hills at its departure from the Livermore Valley, offered still another route. But none of these gaps encouraged the building of a railroad to San Francisco itself. Jameson Canyon led naturally to Mare Island Strait and the creation of a city at Vallejo. Carquinez Strait as a route was tied either to what is now Richmond or to Oakland. Only the Sunol Canyon route could by any means lead logically to San Francisco, and then only by the building of a costly bridge across Dumbarton Strait to the Peninsula. That bridge was built, but it was not completed until 1910, many years after the railroad came to the Bay Area.

The first railroad to be built in the Bay Area was one that started out with high hopes as The Pacific and Atlantic Railroad, but ended as

Map 6: Steam Railroad and Electric Interurban Lines



Only steam railroads and the heavier and more long-distance traction lines are shown. The Petaluma and Santa Rosa Railway in Sonoma County ultimately came into the Northwestern Pacific system, the Sacramento Northern from Oakland eastward through Shepherd Canyon tunnel to Sacramento came into the Western Pacific system, and the Peninsular Railway around San Jose was controlled by the Southern Pacific from its inception.

the San Francisco and San Jose. Joining those two cities in 1864, it provided land transportation on the San Francisco Peninsula. This line was planned as the final section of the transcontinental railroad, making connection with the Sacramento-San Jose link (the earlier Western Pacific) at San Jose. But when the transcontinental railroad opened, the Western Pacific, which used a route from Sacramento through Stockton to Altamont Pass and Sunol Canyon, decided to connect with the shorter line of the San Francisco and Alameda Railroad at Hayward, thus denying San Francisco the status of actual terminus in favor of the San Francisco and Alameda terminus at Oakland. This Western Pacific was soon taken over and merged into the Central Pacific. Also in 1869 a railroad from Sacramento, the California Pacific, reached the Bay by a direct route through Jameson Canyon to Vallejo. In this way the first two connections with San Francisco were made from ports on the east shore of the Bay, and thus by ferry. The route via San Jose, though physically possible, was never used because of its extreme indirectness.

San Francisco's hope of a rail line to the east lay in the building of a line from San Jose to the Colorado River so as to connect with several lines projected across the emptiness of Arizona from the East. Such a project was advanced by way of the Pajaro Valley Railroad, which proposed to build from San Jose to Gilroy at the extreme southern end of the Santa Clara Valley, and from there either eastward through the Pajaro Valley into the Central Valley or southward along the coast. This line, which quickly changed its name to Southern Pacific, did ultimately tie San Francisco with the south. But the connections to the east always remained via Oakland.

The only major changes after 1869 were the shift of the main line of the Central Pacific (later Southern Pacific) from the Livermore Valley to Carquinez Strait in 1878, and the building of a competing line through the two areas pioneered by the Southern Pacific. The San Francisco and San Joaquin Valley Railroad was opened to Richmond in 1900, through the hills south of Carquinez Strait along the line of Franklin Canyon by means of tunnels and a major viaduct south of Martinez. Thus, although the absorption of this line by the Santa Fe led to competition, its entrance into the Bay Area did not create any new areas served by rail. The second, and still continuing, Western Pacific completed its line to Oakland in 1910. But this line had no real impact on Bay Area settlement because it paralleled the original route of the Southern Pacific (first known as the Western Pacific between Sacramento and Oakland) between Altamont Pass at the east end of the Livermore Valley and Oakland.

The Specialization of Inland Navigation

Once the railroads were well developed, the paddle-boat lines began to go into disuse. This should not be thought of as the extinction of water transport or the ending of use of the several embarcaderos. But by 1900 water was no longer used in great measure for local movement. Eventually the paddle-boat and barge traffic became limited to such movements as that of oyster shell to the cement plant at Redwood City, or rice from the upper Sacramento River to elevators and mills around Sacramento, and of sugar beets to refineries. In other words, inland navigation became highly specialized and largely restricted to a carefully organized type of contract-shipping.

Navigation improvements and an increase in agricultural productivity in California ushered in a new phase of shipping that ultimately had a great influence on the morphology of the Bay Area. In the 1860's wheat came into wide cultivation in the Central Valley, as well as in some of the smaller coastal valleys. Production soon far surpassed local consumption, so an export trade began. As Margery Saunders Hellman notes, California wheat was the first grain to be traded by class on the Liverpool Corn exchange.[29] And for a time California dominated the world wheat trade. This situation was due, in considerable measure, to the fact that the settlement of California came earlier than that of the Great Plains of the United States and Canada.

When the industrial phase of gold mining was introduced, some of the men who had come to pan for gold turned to the land to join those who had always looked upon California as an agricultural bonanza. The rapid planting of highly productive but then uncultivated soils in the Central Valley caused a phenomenal demand for transportation in the 1870's and early 1880's that could be met quickly only by river transportation. Soon, however, the wheat flow was too large for local water movement, and came from farms located well back from the rivers. The result, as Mrs. Hellman has shown, was the creation of rail movement to specialized ports, notably Port Costa.

Carquinez Strait served as the site for the world's great grain port in an alignment along the south shore between Martinez on the east and what is now Crockett on the west. Port Costa, midway along this steep shore, was the generic name given to this thin string of warehouses filled with sacks of grain. There, deep water inshore adjoined the main line of the Southern Pacific, which tapped both the Sacramento and

[29] Margery Saunders, "California Wheat, 1867–1910: Influences of Transportation on the Export Trade and the Location of Producing Areas," Unpublished Master's thesis, University of California, Berkeley, 1960.

San Joaquin valleys. In 1879 began the railroad car ferry service from Benicia to Port Costa, which was ended only when the railroad bridge at Martinez was opened in 1930. These massive car-ferries brought wheat from the dry-farming areas on the west side of the Sacramento valley, while the San Joaquin Valley line came along the Strait from Antioch.

The vestiges of the wheat port have virtually disappeared, but at low tide it is still possible to see the piles that supported the wharves in the stretch between Port Costa and Crockett. Fire destroyed those structures, but only to the high tide level. The maritime developments for wheat shipment brought life into Martinez, Port Costa, Benicia, Vallejo, and Crockett. With the ending of the trade, only specialized industry ports were left. After 1900 Port Costa was mainly the southern terminus of the Carquinez Strait rail ferry, although it continued to ship some bricks from the local brickyard. Crockett blossomed due to the use of one of its wheat warehouses and mills for an early sugar beet refinery in 1898—when it was shown that beets were a superb irrigation crop and their cultivation spread quickly through the state's areas under the ditch. The port facilities, however, were not fully used until the American annexation of Hawaii caused a shift in sugar production from beet to cane in the early 1900's.

This development of interior sites with ties to ocean shipping is in rather sharp contrast to the early mercantile stage of Bay Area economic history. Then, the ocean-going ships unloaded at San Francisco's wharves and paddle-boats forwarded the goods to the mines. But toward the end of the nineteenth century trade dropped off, first through competition from the railroad to the east—which turned the trade away from the sea as time went on—and secondly because the Venetian settlement pattern was no longer dominant as towns, factories, and farms came to be located away from the bayshore and river bank.

Factory Ports

The economic development of California did, however, furnish an incentive for the growth of specialized "factory ports" where a single plant received in nearly continuous flow certain raw materials of great bulk. Thus, the Bay Area, like New York harbor and the Delaware River, was dotted along the bayshore with plants pulled to deep water by insatiable material needs. What is now Standard Oil was first located in Alameda in 1880, only to have to relocate to Point Richmond in 1902 because large production necessitated a larger refinery. Subsequently Oleum (Rodeo), Port Costa, and Martinez became such factory ports, carrying ocean shipping well into the inner bays. The later demands for ship canals to Stockton and Sacramento express a

desire of those old river ports to maintain navigation in an era when the paddle-boat trade has disappeared.

The "factory ports" still need rail connections for the out-movement of their product. The typical arrangement was to seek a site where deep water and a rail line came relatively close together, as on the shores of Carquinez Strait or Point Richmond. The Ideal Portland Cement Company at Redwood City, the California and Hawaiian Sugar Company at Crockett, Union Oil at Oleum, Shell at Martinez, or Standard Oil at Point Richmond have such locations.

Another type of rail-water association is that found east of Carquinez Strait in Contra Costa County. The Strait was, until fairly recently, the divide between salt and fresh water in the river-Bay system. But the increasing diversion of water for irrigation and the storage of water behind such structures as Folsom or Shasta dams, has greatly reduced the flow in the rivers. Salt water has encroached on the fresh, pushing the water-divide well into the "delta" in Sacramento and San Joaquin counties. Before this incursion, however, several plants had been set up on the gentle slope between Mount Diablo and Suisun Bay. The Columbia-Geneva Steel plant, which caused the renaming of "New York of the Pacific" to a misspelled "Pittsburg" in 1909, is such a plant. Steel making requires more water than any other raw material, so a site on the fresh-water Bay was highly desirable, particularly as the railroad (Santa Fe) ran along the inland boundary of the property. After the invasion of Suisun Bay by salt water, these plants secured relief through the building of the Contra Costa Canal, diverting water from farther inland and thereby securing cheap water fresh enough to be used in steel making.

The Railroad Towns

The physical growth of a metropolis takes place along lines of communication that may be used for diurnal movement. Thus, in assessing the shaping of urban structure, we must first be concerned with the availability of transportation lines, and second, with their practicability for daily use.

The rapid expansion of the area tied to San Francisco through daily movement by steamboat, led to the early growth of East Bay towns—Oakland, Berkeley, Encinal, and Alameda. But when the investment could be justified through a reasonable expectation of profit, the already available technology of railroad operation was called into use. Due to the eccentricity of San Francisco's location, however, railroads could be used effectively only along the Peninsula. Even there, the presence of rough terrain south of Yerba Buena Cove, including Potrero Hill and San Bruno Mountain, limited close-in suburbs and determined that the initial rail construction would be cheapest if carried southwestward out of the city, through the Mission District, to skirt San Bruno Mountain on the west, returning to the bayshore at San Bruno.

This alignment had two major effects on the settlement pattern of San Francisco. First, because of its indirectness it created a gap between the city and the areas where suburban development might take place. This "filler" increased the friction of space beyond that required by straight line distance. The detour through what is today Ocean View in San Francisco, led the line into a section of fog and wind that was not, at that time, highly regarded for housing. And the return to the fog-protected east shore of the Peninsula was far enough away from the city to be relatively costly to reach by train.

This fact encouraged a phenomenon then beginning to develop on the Peninsula. The money that had come from the industrialization of mining—most notably in the Comstock Lode operations—was being spent by the California magnates on the rapid creation of a landed-class with Peninsula estates. Nature had encouraged this. The inner part of the Peninsula was clothed by an oak-grassland association, with some redwood, that has come to be called the California park landscape. In 1792 Capt. George Vancouver chose to picnic in San Mateo and, perhaps because it was November and we may infer that the grass was green, found it acceptable to his British eye.

> The stately lords of the forest were in complete possession of the soil, covered with luxurious herbage and beautifully diversified with pleasing eminences and valleys; which, with the range of lofty, rugged mountains that bounded

the prospect, required only to be adorned with the neat habitations of an industrious people to produce a scene not inferior to the most studied effects of taste in the disposal of the grounds.[30]

The magnates could lay claim both to industry and to this natural parkland that met the requirements, in a natural state, of the landscape made fashionable by "Capability" Brown's 18th Century country seats.

With the coming of the railroad these estates could possess the two desiderata of a country seat: They were far enough from the city, and synthetically wild enough, to create an impression that the owner was of the country rather than of the city, and they were approachable in a genteel manner, that is by train. Thus, when the railroad opened through this belt in 1864, there was a rapid growth of railroad towns—Burlingame, San Mateo, San Carlos, Belmont, and Atherton. In the latter the daughter-in-law of the baronial family noted the requisite structure of such an exurban area. Gertrude Atherton saw that this rurality must be both selective and convenient. Visiting was essential to the social life, and visiting required a stratification of society and the clustering of the small elite in a very limited area. The San Francisco Peninsula served for all but the eccentrics, such as the Hearsts, whose arcadia was found at Pleasanton in the Livermore Valley. Although the Pleasanton site was bought somewhat earlier as a relatively simple ranch, in 1892 Phoebe Hearst began the architectural acquisition—for which the family became notorious—with a five-ton Italian well-head that gave the place its name, *Hacienda del Pozo de Verona.*

Another effect of the building of the railroad was to provide, for the first time, a counterpoise to the ferry slips in the location of San Francisco's business center. In 1863 the terminus of the San Francisco and San Jose Railroad was established first at Mission Dolores and soon after at Market and Valencia streets. There were some attempts to continue steam trains down Market Street, terminating, with considerable élan it must be said, at the Palace Hotel. But in 1868 an ordinance was passed refusing the use of Market Street for steam trains. Such a distant station as that at Market and Valencia streets made daily commutation to the Peninsula difficult. And the fare policy of the Southern Pacific was equally chilling. Even after the company had opened the bayshore cutoff line east of San Bruno Mountain in 1907, its fares stood high for the Bay Area.

In 1913, Bion Arnold contrasted the 11 cent fare from San Francisco to North Berkeley with the 13⅓ cent fare for the same travel time on the Peninsula, saying "This disparity of commuter rates is directly

[30] U. S. Works Progress Administration, Federal Writers Project, *California, A Guide to the Golden State,* New York: Hastings House (Revised edition) 1954, p. 372.

responsible, in my judgment, for the particularly erratic development of San Francisco, automatically reserving the attractive foothills of the Peninsula Coast Range for the rich land owner."[31] Perhaps the Southern Pacific had such a goal in mind. For the stockbroker's clerk or petty bank official, Berkeley or Alameda offered more reasonably priced land and much cheaper commuting to the San Francisco terminal (the Ferry Building), to which he could walk with ease from his job in the financial district. From this situation, we may logically infer that the Southern Pacific Peninsular line railroad connection directly to San Francisco had more effect on the location of the industrial-warehouse area south of Market Street than it had on the location and prosperity of the financial district.

The Peninsular line was important for the small executive group. But in the workers' view it was a line to suburbs that were largely closed to them. In this, San Francisco was similar to most other American cities having strong social segregation of housing by sectors outward from the center. In San Francisco, however, the various economic classes of workers used different *means* of transportation, in contrast to the situation elsewhere. This multiplicity of commuting modes has led to considerable differences in the impact of new transportation technologies on the several income-occupation classes. The railroad in San Francisco was supported by "stockbrokers' suburbs" on the Peninsula. This relationship has continued to the present. The San Francisco-East Bay connection, on the other hand, was originally by ferry. Within the East Bay, commuter-rail connections were relatively unimportant, and suburban development was small and circumscribed until the trolley came in the 1890's.

The Ferry to the Office

There were, however, some railroad towns in the East Bay area during the early period. The first ferries reached the East Bay at the foot of Broadway on the Oakland estuary in 1852. In 1863 the Oakland Pier was built and service was speeded up. Even at that time there was some commuting across the Bay, particularly to what is now Alameda. Small-holding was carried on there, leading to the creation of a true horticultural landscape only to be replaced in the 1880's and 1890's by relatively small houses occupied by commuters. An odd system of street-running steam-train lines came in to supply commutation. By 1880 Alameda had reached a population of five thousand, outdistancing the archetypal Peninsula suburb of San Mateo for forty years. Not until 1960 did San Mateo again take the lead.

[31] Bion Arnold, *op. cit.*, p. 5.

We cannot be certain how many people moving about the Bay Area in the late nineteenth century were engaged in daily commuting, as opposed to going to the city for occasional business. The figures for the transbay ferries do suggest, however, that there was a sizable group living in the East Bay and working in San Francisco well before the 1906 fire. By 1873 there was an annual total of 2,655,671 ferry passengers between Oakland and San Francisco. This figure doubled within four years and reached forty million by 1912. On a pro-rata basis of 25 working days a month, the fares remained at 12 cents a day round trip for commuter tickets throughout this period. Thus, the financial impact of the ferry journey was relatively small and decreasing. As early as 1877 Sausalito, Berkeley, and San Francisco ferries had fares identical with those to Oakland. The journey took from twenty to thirty minutes throughout most of the period of 106 years when San Francisco-Oakland ferries were run.

From the Oakland and Alameda piers, railroads ran toward the southeast, down the flat plain that forms the East Shore. These lines opened Alameda Island and East Oakland for housing. Street-running railroad lines served the same purpose for Berkeley after 1876. Thus the central urban Bay Area comprised four municipalities of major importance until rather recently. The following table tells this tale:

Year	Population of S.F.	Population of Oakland		Population of Alameda		Population of Berkeley		Total of 3 East Bay Cities	Total of 4 cities
1870	149,473	10,500	+	1,557	+	....	=	12,057	161,530
1880	233,959	34,555	+	5,708	+	....	=	40,263	274,222
1890	298,997	48,682	+	11,165	+	5,101	=	64,948	363,945
1900	342,782	66,960	+	16,464	+	13,214	=	96,638	439,420
1910	416,912	150,174	+	23,383	+	40,434	=	213,991	630,903
1920	506,676	216,261	+	28,806	+	56,036	=	301,103	807,779
1930	634,394	284,063	+	35,033	+	82,109	=	401,205	1,035,599
1940	634,536	302,163	+	36,256	+	85,547	=	423,966	1,058,502
1950	775,357	384,575	+	64,430	+	113,805	=	562,810	1,338,167
1960	740,316	367,548	+	63,855	+	111,268	=	542,671	1,282,987

Before 1930 there were no defined census metropolitan areas in California, but we are justified in using the five central counties as an area that is now metropolitan. Within these five counties the population was as follows:

Year	5-County Population	4-City Population	4-City Population as a Percentage of 5-County
1860	77,605	58,845[a]	75.83
1870	195,709	161,530[a]	82.54
1880	329,453	274,222[a]	83.33
1890	429,535	363,945	84.73
1900	518,821	439,420	84.70
1910	746,416	630,903	84.52
1920	968,865	807,779	83.37
1930	1,306,938	1,035,599	79.24
1940	1,412,686	1,058,502	74.93
1950	2,135,934	1,338,167	62.65
1960	2,648,762	1,282,987	48.44

Thus by 1860 the Bay Area was dominated in residential development by Oakland and San Francisco. These two came to share dominion with Berkeley and Alameda by 1890 (other portions of the East Bay became important by 1940–50–60: Hayward, San Leandro, Richmond, etc.). And in the last three decades the share of the five-county population represented by Alameda, Berkeley, Oakland, and San Francisco has dropped from four out of five to one out of two. In much the same way, these four cities' share of the total urban population of the state has declined sharply:

Population of Four Cities as a Percentage of Total Urban California

Year of Census	Percentage
1860	74.77
1870	77.50
1880	73.99
1890	61.74
1900	56.57
1910	42.96
1920	34.71
1930	24.89
1940	21.59
1950	18.56
1960	11.38

San Francisco's census returns for 1850 burned, while those of Contra Costa County were lost. But in the full century for which we have returns, these four cities have seen their hegemony as the core of urban life in California broken. While they furnished three out of four urban

[a] Only three cities, Oakland, Alameda, and San Francisco.

people during the 'sixties and 'seventies, today they account for little better than one out of ten. The peculiar urban culture and attitudes that we shall have reason subsequently to associate with the four old cities has an obvious historical basis. At one time that culture could also claim to represent urban California to the outside world. Today it is very much a minority culture engulfed in the extensive urban culture that has grown up in other parts of the Bay Area, in the multi-centered urban areas of the Los Angeles basin, around San Diego Bay, and in the Central Valley.

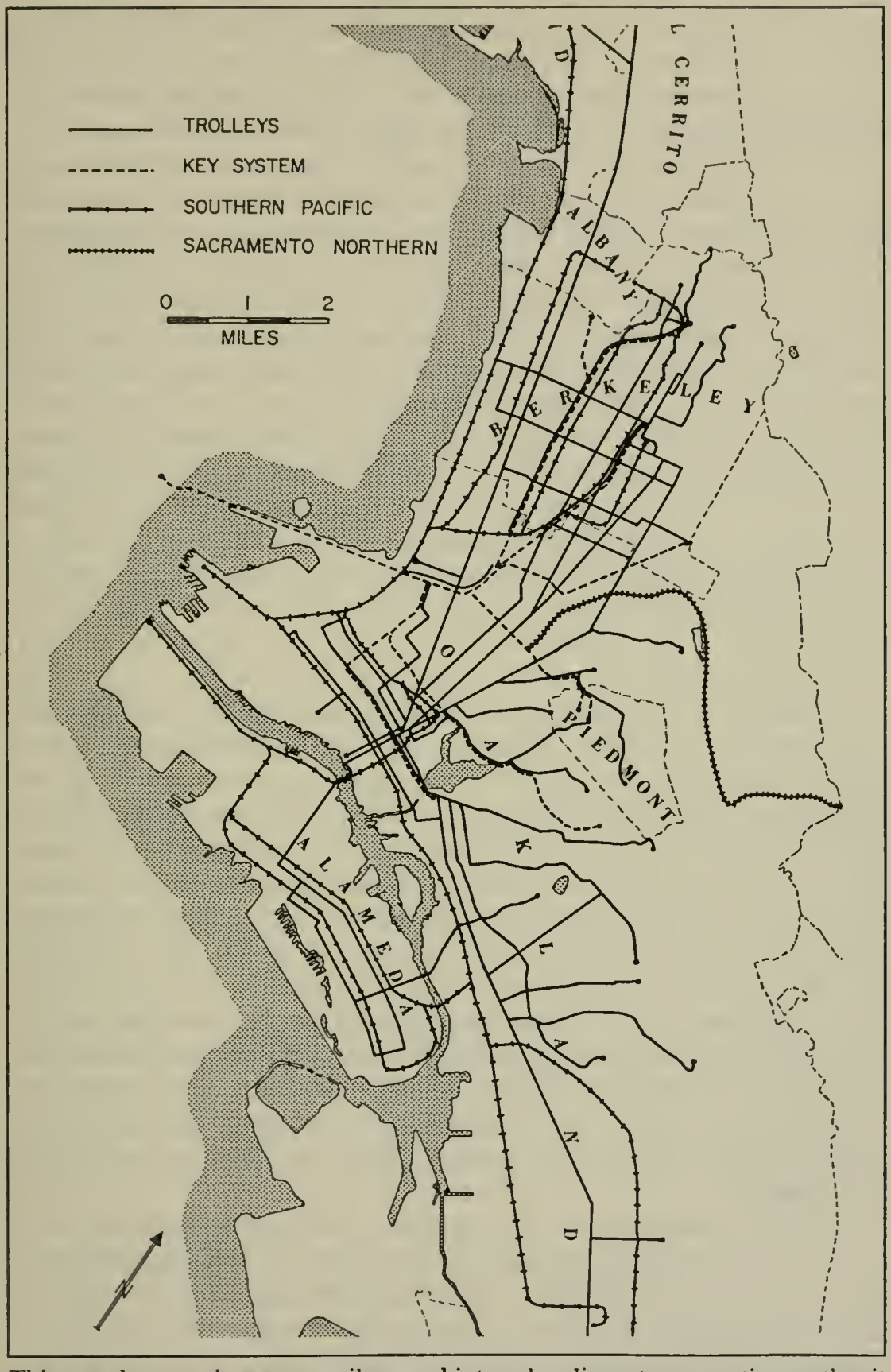
The Trolley Wire Leads Into the Country

All the world knows about San Francisco's cable cars, largely because they have resisted change. Perhaps far fewer people know that San Francisco not only saw the very first cable cars, but also still enjoys what are now the world's last operative examples of these highly specialized vehicles. Andrew Hallidie invented the cable railway in response to San Francisco's need of the 1870's, when development was restricted to the narrow confines of Yerba Buena Cove and its hilly frame. The streets that ran straight up the hill—from the relatively flat land formed by the filled-in cove—were almost unusable for ordinary horse-car lines. This was primarily due to the difficulty of securing adequate brakes on these vehicles, rather than inability to crest the hills with four-horse teams that pulled the cars.

As a cable manufacturer with considerable experience in California's mining industry, Hallidie logically proposed to solve the dual problems of surmounting the hills and descending again, safely, by raising and lowering the car on a cable. Much interest attaches to his solution of the problem of moving and stopping by use of the "grip." In essence, the cable car was as important for its braking ability as it was for its motive power source. This fact is shown by the speed of the original line (1873) up Clay Street Hill. The cable on that one-mile run moved at a rate of about six miles per hour. Such speeds were dictated partly by the technical necessities of attaching and disengaging the cable, but also by the utility of the cable as a braking system. In truth the cable car was a specific vehicle for a special need.

Cable railways were built outside San Francisco and beyond the steep hills within the city. But their aggregate length in the United States never greatly exceeded five hundred miles in a total of fifteen or sixteen cities. In the Bay Area, Oakland had cable cars on Broadway, and Berkeley laid out a street for cable cars—Marin Avenue—although the line was never built. These railways had obvious virtues with respect to motive power in the heart of cities where the very high capital cost of lines, perhaps exceeded only by other urban rapid transit facilities, could be met. But at $50,000 to $100,000 a mile, and with considerable limitations on the radial extent of lines, the cable car route began as a heart-of-the-city contrivance, and so the sole remnants in the San Francisco lines stand today. Once the investment had been made for the cable line, of course, its operating costs were low. But after a cheaper

Map 7: Traction Lines in the East Bay Area



This map does not show street railway and interurban lines at any one time; rather it shows each line at its greatest length. In addition to a number of street-car lines there were two heavier traction systems, the Key System and the Southern Pacific Electric lines, that were built separately, often competitively, and survived to 1958 and 1940 respectively.

means of transport was invented which had tractive and braking abilities equal to the cable railway, no more cable lines were built. By 1887, an electric traction motor developed by Frank Sprague secured those advantages at a fraction of the cable railways capital cost.

The electric traction motor has never been improved upon as a source of motive power for mass transportation in cities. It combines great sturdiness with great simplicity; and superb qualities of acceleration with the use of the motor as a brake (like the internal combustion engine). It has fine hillclimbing abilities that are unrecognized by those who know only outmoded versions of the trolley. The high efficiency of the electric traction motor has frequently been unappreciated in recent decades, because the trolley was either ill-repaired or ill-patronized. Fond as they are of cable cars, San Franciscans cannot deny the wisdom of the rest of America in discarding the grip car and wire cable at the turn of the century. The virtues of electrical power transmission are indeed great in comparison to mechanical transmission via a cable. The effects of that substitution on the physique of the city are highly significant.

The Streetcar Suburb

It is hard to say whether the trolley produced the metropolis or vice-versa. In any event, we may date the transformation of most American cities from the stage of simple urbanism to complex metropolitanism in the first or second decade following the introduction of trolleys. This change was so marked that Sam Warner in *Streetcar Suburbs* tells us that "In 1850 Boston was something familiar to Western history and manageable by its traditions. . . . By 1900 it had become, along with many European and American cities, something entirely new, an industrial and suburban metropolis."[32] If modern economy begins with the early machines employed in England's textile industry just before the American Revolution, we should date the modern city with the introduction of the trolley. It was the first technological development that made consolidation of activity in the metropolis consonant with the maintenance of a metropolitan population in health and comfort.

The train transported a small segment of the population in those cities where rail commutation was employed. In this, San Francisco was entirely typical. The ferry was more plebeian if less widely practicable. Suburbanization came earlier in San Francisco than in all but a handful of American cities—Boston, New York, and Philadelphia—

[32] Sam B. Warner, Jr. *Streetcar Suburbs: The Process of Growth in Boston, 1870–1900,* Cambridge: Harvard University Press and the M.I.T. Press, 1962, p. 3.

because the ferry was practicable here. But even in the Bay Area the creation of a metropolis waited for the trolley.

In reflecting on *The Growth of Cities in the Nineteenth Century* in 1899, Adna Weber found a grim situation.[83] The need for bringing people together in workplaces that soon became cities led by 1850 to the creation of a settlement form so dismal as to appall us even in an era of nuclear warfare. As late as the time Weber was writing, it was seriously questioned whether urban man could biologically maintain his numbers. In 1850 the essential industrial and commercial need for cities was an outgrowth of the fact that it was impossible to do more than crowd people together at the chosen spot. *Congestion was the first state of industrial urban life*—a fact that led the improvers to propose, as Weber did in 1899, that the main solution to the woes of the city should be "decongestion," a process we equate today with suburbanization.

Precision would require that we distinguish between true decongestion, which implies an orderly and rational positioning of activities *within* the city area, and thereby the maintenance of the most efficient linkages of activities possible, and decentralization, which implies flight *from* the center, as is the case today. The latter phenomenon, decentralization, resulted to a considerable degree from the substitution of dogma or doctrine for analysis. The sort of planning proposal that calls for the introduction of greenbelts or "New Towns" in the United States simply because they are highly thought of in Britain, rather than as a means to the clearly defined objective of decongestion, falls in the class of doctrine (as opposed to analysis). In 1898 that crabbed deity of decentralization and father of the "garden city" movement, Ebenezer Howard, could find no solution beyond such flight into the rural frame of the city where the settlers sought bucolic rather than urban life.

The trolley line was particularly adaptable to the provision of city transportation on a broad scale. If the ferry made an American Venice of the Bay Area, the trolley shaped parts of it in the image of Chicago or Indianapolis. The streetcar line immediately suggested a tie between land speculation and traction building. In most parts of the United States the first large-scale land platting strictly for residential uses came with the trolley. Still earlier, the railroad in most cities, and the ferry in a few cities such as San Francisco, had led to the creation of "town nuclei" removed from the central core. The extreme focus of these two means of transport suggested the creation of a microcosm of the core at the "embarcadero" or the "depot." Around the shopping center

[83] Adna Weber, *The Growth of Cities in the Nineteenth Century*, New York: The MacMillan Co., 1899. (Reprinted by Cornell University Press, Ithaca, New York, 1963.)

the suburb assorted itself in a manner borrowed from the core city. But with the coming of the trolley, focus on a single suburban railroad station was no longer the certain outgrowth of construction. Instead the line brought a large expansion of urban land; land prices allowed the rapid and flexible growth of the core city.

The Prairie-form Metropolis

San Francisco and Oakland spread without clear limits on additions. The result was a form that we still may see in the Bay Area and in other Prairie-form metropolises. The trolley line followed a street radiating from the city core; such was the easiest way out for a transportation form that was intermeshed with land speculation from the beginning. In most cases the choice of street was obviously dictated by the direction of the promoter's land holdings from the downtown. Once in the vicinity of those holdings, the trolley line might be diverted to serve more of the tract than would a line merely passing through. Such diversion could be justified on the basis, not so much of increased transit income expectations, as of increased land-sales profits. The short-term gain was more predictable than that from long-run operation. This fact did, at times, make economical running of the lines difficult. But the subsequent poor earnings of streetcars may, in retrospect, justify this view of the carline as primarily a device to encourage real estate development.

Trackside Commerce

Once the housing lots had been sold, it became obvious that some provision must be made for shops and service establishments. Without the focus provided by earlier forms of transport, the result in the time of the trolley was generally a non-selective strip of commercial land use. We should not forget that even in New York City, where the heavily capitalized transit system provided sharp differences in focus, the first zoning ordinance begged the question of making judgments of appropriateness for commercial location, and simply zoned each avenue for strip-commerce. It was almost inevitable that this would also happen elsewhere.

In the "Prairie" parts of the Bay Area—the outer Mission District of San Francisco, East Oakland, West Berkeley, and parts of the outskirts of San Jose—this rather spontaneous strip-commerce sprouted. Where trolley lines intersected, the growth was more lush and vigorous, and was not controlled by the later strictures of zoning. Thus new sub-centers came into being that were primarily derivative in nature, rather than planned. Fruitvale Avenue in East Oakland, University

and San Pablo avenues in Berkeley, or the business center of old Daly City serve as examples. At the inception of land-use controls, zoning largely legitimatized existing concentrations and uses.

There were several marked advantages of this system. It profited from its derivative nature. If a shopping center sprang up from a local focus of trolley riders, it could be considered economically viable. Also, this system did not create the inefficient single-use zones of the automobile era that followed. And the relative ease of entry for a new venture into such a commercial structure encouraged diversity of business establishments. But all was not worthwhile in trolley commercial-strip structure. The weak focus of internal flows in the city meant that most of the streetcar business districts were highly localized. There was a great tendency for the shops to be directly reflective of the social and economic characteristics of the population living close by.

In time the ease of entry into the local business district resulted in excessive parceling out of markets. In the 1920's the rash of small grocery stores was so great, and commercial-strips developed such an abundance of marginal shops, that change was imperative. The 1930's had to produce the supermarket to overcome the excessive proliferation of groceries and the bad effect it had on food prices. Only in areas with sufficient socio-economic means to pay for "service" could the locally-oriented food store survive. Today on Russian Hill in San Francisco, on Claremont Avenue in Berkeley, and in downtown San Francisco—with its specialized financial district clientele—we find the "fancy grocery" with its implication of high mark-up. Elsewhere the small number of corner groceries that survive are often either ethnic in orientation or run by relatively recent immigrants who work long hours for a low return.

The Trolley: a Tool of Speculation

The strip development of commerce was merely the façade. Behind it lay the housing of the trolley era. These sections stand out in several ways. In the first place they are the oldest remaining areas of relatively uniform mass housing. Previous speculative building in San Francisco, Oakland and towns of similar age has, in the main, been swept away by the growth of the city core. This removal occurred at both ends of the pre-streetcar era housing spectrum. The poor housing, such as that along Harrison Street in San Francisco, and the good, as on Nob Hill, or Adams Point in Oakland, have both been replaced. In the former case warehousing and core-area industries such as printing have been substituted, whereas in the latter case the central business district has advanced and an apartment area has grown up. In contrast, the trolley-

era housing is still with us because it represented the beginning of functional decongestion, which is still the main dynamic force at work in our cities.

The trolley is no longer used in the Bay Area, and most of the street railways have disappeared. But the shape the trolley wire gave to Bay Area housing is still well-preserved. Indicators of the streetcar suburb are varied. As Sam Warner has noted in Boston's suburbs, the street-car was tied to the speculator in land or buildings.[34] Thus, the developer's appraisal of the highest use of an area was reflected in its initial form. If the subdivider thought an area capable of high-value housing development, the physical structure of the plat generally reflected that view in larger lots, in some attempt at design as well as division, and in more "trimmings."

Some of the older residential sections of the Bay Area—Berkeley, Piedmont, or Redwood City—are dotted with ornamental gateways bearing names of plats that are unwittingly dated. The "Olde English" tract was followed in turn by the "Golf Scottish" and the Spanish. These plats cannot, despite a long and heroic attempt to confer individuality through portal architecture, overcome the formlessness of streetcar development and its aftermath. Warner found that the growth of streetcar Boston resurrected the pre-existing Colonial villages with some social success. But in California the rancho was too limited socially and often too transient to confer individuality on the raw land which the trolley opened for development.

Where middle-class concepts of the durability of the family and its residence required identity of place, the gates we have noted were built. Elsewhere land was quickly divided and sold in the most easily merchandised packages. The streetcar era in cities like Alameda led to narrow lots and the use of a street frontage module for division. This compares rather poorly with the terrain-influenced lots in the Oakland and Berkeley hills, whose frontage varies and whose development suggests forethought, at least, if not always taste. The inexpensive trolley housing areas even lean toward uniformity of architecture. Large sections of the East Bay cities stand with long street frontages filled by obelisk-supported porches attached to rambling bungalows. In San Francisco land values ruled out the bungalow, but blind-sided stucco buildings served in their stead.

A Metropolis Succeeds the City

In the beginning the Bay Area was San Francisco, but rapid growth during the technology of the trolley destroyed the unified city. The

[34] Sam B. Warner, Jr., *op. cit.*

major economic activities of the city were those of the merchant and banker. Spreading seaward as well as landward from the beach along Montgomery Street, four cities—whose physical structure and actions were tied together by the transbay ferry routes—emerged to dominate the scene. The merchants and bankers, and many of those they hired, circulated in daily movement among these places. But with the coming of the streetcar line, more and more people crossed the Bay only on rare occasions. So long as ferries provided the transport for local movement, the city was unified with the traditional core near Yerba Buena Cove or, later on, the Ferry Building. But when trolley links were established among the East Bay cities, much economic activity could be carried on independent of San Francisco. At that point, we may date the birth of a Bay Area metropolis, as distinct from the entrepôt and the Venetian confederation that was San Francisco during its first half century.

The growth of the East Bay towns between 1900 and 1920 is clear evidence that for many people San Francisco had been transformed from the center of men's life and concern to the status of a state-church, revered but unvisited. So it has remained for much of the time since, a fact that has caused considerable bewilderment to the residents of San Francisco, who tend to confuse their own dependence on the city with universal need. On the one hand, the proper resident of the Bay Area considers San Francisco "the City" and the great glory of the American West. His life is spiritually tied to such a Rome, even though his journey becomes ever more commonly a pilgrimage in function. The reflective metropolitan resident knows this.

On the other hand, the metropolitan resident, as opposed to the resident of San Francisco, has long demanded convenience and commercial equality for his segment of the Bay Area metropolis. Outlying towns have developed shops as well as factories, and have little need to visit the shrine. But the keepers of the flame in "the City" have not appreciated this weakening of dependence. To the San Franciscan, the objectives of Oakland are pretensions. Similarly, the local residents' affection for Berkeley is unfathomable: an obeisance to a sort of modern-day Avignon.

As the Bay Area metropolis grew, new groups arrived that were totally unaffiliated with "the City." The Bay Area began to serve as a place for retirement. With the diminution of income that most retirement immigrants experienced, the core city had little appeal and the trolley-car tracts a great deal. Oakland, in particular, was popular for this purpose. Warmer than San Francisco, less costly and conforming more to the non-Californian's concept of California life and vegetation, and perhaps

more comfortable to those untouched by Bay Area "religion," Oakland and the East Bay grew through retirement support, owing no gratitude to San Francisco.

It has been necessary to examine the growth of the Bay Area under the trolley wire because it is commonly assumed that the region had a single shaping force (the railroad) before the coming of the automobile and the building of freeways. If this were so, much of the urban East Bay would be inexplicable.

A survey at the end of the trolley era would show changes in the physique of the Bay Area. San Francisco still served as the office and shopping center; but with the wire, settlement went to places such as Piedmont, east of Oakland. There the trolley created a carefully sifted town of expensive houses in hilly country. The Berkeley Hills were climbed in several places between Kensington in Contra Costa County and East Oakland, and always by trolley cars rather than cable cars.

The value of interchangeable cars is very well shown by the Oakland, Antioch and Eastern Railway, whose line through the Berkeley Hills was opened in 1913. First operated along the Key System tracks from the Key Route Pier to 40th Street and Shafter Avenue in Oakland, the OA&E began its own line with a stiff 3 per cent climb to a three-thousand-foot tunnel at the head of Shepherd Canyon. Once east of the Berkeley Hills, this line had many variations—a change from wire to third rail, a traction ferry across Suisun Bay, an 11,000 foot trestle across the Yolo Bypass—and the distinction, when the line connected to the Bay Bridge Terminal in San Francisco in 1939, of having the longest traction run in the country. Through service provided was for 183 miles from San Francisco to Chico. Few lines could match this versatility, but hill climbing was common.

As the map shows, there were trolley or interuban lines along Arlington Avenue and Euclid Avenue in north Berkeley, to the Claremont Hotel in the Claremont district of Berkeley-Oakland, along Mountain Boulevard and Shepherd Canyon in east Oakland, along Highland Avenue and Oakland Avenue in Piedmont, and to the lower slopes of the hills along Park Boulevard in Oakland. These lines connected the more expensive residential areas with the central business districts of Oakland and San Francisco. In Berkeley, especially, their presence is shown by a series of "paths" and "steps" which permitted hill residents a much more ready access route to the car tracks below than would have been possible along the streets laid out for carriages or automobiles.

The East Bay Catches Up

The car lines were dense on the great sloping plain from the foot of the hills to the Bay. There was competition between the electrified former steam lines of the Southern Pacific and the newer Key System. As early as 1876, the Southern Pacific built a steam line to what became the center of Berkeley. The Southern Pacific also took over steam lines along several streets in Alameda that had been laid with track before 1879. These lines were electrified around 1910. In addition, the Southern Pacific gave mainline railroad service both north and south of Oakland. Thus, it is chiefly in the East Bay that the streetcar came into independent existence.[35] It is most significant that the population growth in the Bay Area outside San Francisco was, between 1900 and 1930, much greater in the trolley-served East Bay than in rail-served Peninsula and Marin County. The East Bay probably added nearly 400,000 people in those thirty years, while the two peninsular suburban areas added perhaps 75,000.

POPULATION OF THE "RESIDENTIAL" AREAS OUTSIDE SAN FRANCISCO

Year	EAST BAY CITIES		CITIES ON THE WEST BAY PENINSULAS (Excluding San Francisco)	
	Total	Percentage Increase Intercensal Period	Total	Percentage Increase Intercensal Period
1900	100,850	.....	11,077	.....
1910	226,066	124.16	20,800	87.78
1920	335,577	48.44	37,745	81.47
1930	460,055	37.09	84,011	122.58
1940	496,441	7.91	117,186	37.49
1950	764,378	53.97	225,240	92.21
1960	868,022	13.56	405,367	79.97

This contrast between the two sides of the Bay is striking when we look for the remains of the trolley era. In the west the evidence is strong that the overhead wire had little effect, mainly because it was little used. In San Francisco itself, of course, the lines were many and important. Beyond the city limits, however, there were few routes and the character of the metropolis is given by railroads. The steam service down the San Francisco Peninsula was paralleled so closely by the Market Street Rail-

[35] Trolleys were used, however, in other portions of the Bay Area, including Santa Clara and Marin counties.

way as far as San Mateo that the streetcar line had little independent influence on development. There is a string of discrete shopping centers at fairly regular intervals each surrounded by a ring of housing.

Only along El Camino Real on the Peninsula is there appreciable commercial strip development. That occurrence can easily be explained by the distinction this road holds as California's first state highway, established in the very early days of automobiles. Also there was little lower-priced housing on the two peninsulas. In Redwood City an early industrial development in timber working and tanning seems to have engendered a bit of lower-priced housing, but elsewhere the suburban development was relatively high priced, as one would predict in an area where the trolley had little development, and where the commuter train still holds sway.

Outside San Francisco the contrasts in trolley line construction had considerable influence on factory development. In the era before widespread ownership and use of automobiles, the streetcar was a critical facility in the journey-to-work. The author's investigations in eastern Massachusetts showed the trolley to be the first public transport widely used in bringing factory employees to their work.[36] And Sam Warner's recent study has shown that the "cross-town" lines have been the workers' lines.[37] This in itself would suggest that the limited building of Peninsular car lines was geared primarily to the bankers' and merchants' journey-to-work, rather than to commuting by the factory hand.

In the East Bay, however, the lines show a remarkable ramification with strong evidence that it was relatively easy to move within the periphery, as opposed to movement in and out of the center. The East Bay also has industrial districts in Emeryville, Berkeley, Richmond, East Oakland, and San Leandro that date back to the time of the trolley wire. Those concentrations differ markedly from such very early industrial locations as Hercules or Selby in Contra Costa County, or at Redwood City. The East Bay industrial districts do not represent an integration of housing and plant, such as was necessary before workers were able to "commute."

In the case of the San Leandro and East Oakland industries, the plant is in the general section of the metropolis where industrial labor might logically be found, but not in immediate association with workers' housing. The distribution of canning plants, with their highly periodic employment, shows this relationship. Those built in the earlier part of this century were marginal to the big towns in the East Bay, or else placed directly in the orchards, as in Sunnyvale and Mountain View. The

[36] James E. Vance, Jr., "Labor-shed, Employment Field, and Dynamic Analysis in Urban Geography," *Economic Geography*, 36:189–220, July, 1960.

[37] Sam B. Warner, Jr., *op. cit.*, p. 64.

plants in West Berkeley and San Leandro, for example, were located where produce shipment could be facilitated, but were also situated not far by streetcar from the housewives who did the actual packing when the crop was brought in.

This industrial expression of the streetcar era is still with us. The plants built along trolley lines are still highly usable and form the "seed bed" for much new industry. We may be rather puzzled at the constant turn-over of occupants in these plants along the now torn-up car lines. But a turn-over appears quite logical when we realize that the physical plant has outlasted the conditions that caused its construction.

The City of Automobiles

Although cities offer strong evidence of the forces that have shaped them, they do not tell us when and in precisely what manner the molding was done. We can see that the trolley transformed the core-centered city into a metropolis of parts. And we can now see that the automobile has remade the metropolis most radically, strengthening the centrifugal tendencies. But we cannot say precisely *when* the trolley became weaker in the shaping of cities than the automobile, mainly because the two operated together through much of their joint-tenancy. Certain characteristics of the automobile were distinct in their effect, however, even at the very beginning.

We have seen that the railroad and the street railway made possible the separation of residence from workplace. The separation did, of course, necessitate the introduction of urban transportation into the daily lives of most urban people, with the result that the city dweller's budget came to include an item for economically costly travel. The size of the expenditure tended to vary with economic class. The well-to-do accepted a higher absolute transport cost, which led naturally to their living both farther away from the core-city and along the more expensive railroad lines. But the well-to-do could never be numerous enough fully to develop nearby shopping centers catering to all their needs. At first much shopping was done in the central city, but this was not a satisfactory solution.

Short of going to San Francisco, the upper-income groups had to find a better means of moving about in their more dispersed suburbs. The automobile offered that means, and we find women early came to use cars for the journey-to-shop, strengthening the more expensive outlying shopping centers such as San Mateo or San Rafael. This development contrasts markedly with the post-war experience in Britain, where increasing affluence has not been matched by the development of car-served shopping districts. The ownership of automobiles has risen, but their use is still more masculine than was the case in the United States in the 1920's. And the vehicles serve more for pleasure driving, with heavier purchase of sports cars as a result. It seems that the car is considered a luxury in Britain to a degree it never was in the United States.

It is logical to assume that cars came into use for both practical and sport purposes. They were in early practical use where other forms of transportation provided poor service, if any at all, in what might be called the *American purpose*. They also came into use early for sport and pleasure driving, a purpose so long maintained in most driving in

the United Kingdom that we may think of this as the *British purpose*. In the Bay Area both purposes held sway, but the American one was the only one with much impact on settlement forms. In this the local experience conforms to the experience in Britain, where only now is the automobile having much effect on settlement patterns, although Britain has long been very important in both car ownership and manufacture.

Change Comes at the Edge

The automobile first shaped the city at the urban fringe where no public transportation could hope to earn capital costs. Service was normally available at the edge of the built-up area only where a railroad or interurban line led from the Bay Area to Sacramento, Stockton, or San Jose. Such adventitious transportation created thin tendrils of settlement in places like Lafayette, Walnut Creek, and Concord, along the south shore of Carquinez Strait and Suisun Bay, and in the Livermore Valley. But the transportation provided was generally slow, depending on some sort of infrequent local train stopping at all stations over a long distance. Thus the housing built around Canyon, Lafayette, Saranap, or Niles was largely occupied by small-holders living on a pension of some sort, or shunning standard mores of income expectation. The result was a rather "informal" architecture, perhaps beginning as a week-end "camp" and slowly growing, sometimes to considerable size, to become year-round housing. But this sort of location could not be integrated into the normal metropolitan economy until a better form of transportation was available. The automobile supplied better transportation, and the "camp colonies" showed a rapid upgrading in size of housing and in the income of the full-time occupants when the car began to be used.

California: The Auto State

In California the ownership of cars was always well ahead of the per capita ownership for the nation as a whole or most other states. No doubt, one reason for this high per capita ownership was the rapid growth of population—especially urban population—between 1910 and 1940. As the accompanying table shows, California was high in the percentage increase of urban population between 1900 and 1910, as compared with other states having any appreciable urban population. During the next decade, 1910–20, only Michigan (among the urban states) had a more rapid city growth.

With the advent of the automobile era at the end of the First World War, however, California showed the greatest increase for an urban state. The absolute size of its growth in city population between 1920

Urban Population Increase, By Decades

	California	Oregon	Texas	Michigan	Illinois	Ohio	Pennsylvania	New Jersey	New York
1900–1910	691,599	173,880	417,345	364,721	863,567	666,761	1,182,059	609,450	1,890,020
1910–1920	858,540	83,286	574,585	914,516	923,747	1,011,993	1,041,784	583,823	1,400,455
1920–1930	1,833,637	99,400	876,659	1,060,515	1,232,050	830,235	861,058	816,809	1,933,366
1930–1940	741,669	41,929	522,041	152,792	173,923	105,615	53,366	55,529	643,941
1940–1950	2,306,560	200,572	1,701,277	711,298	677,029	733,350	398,532	523,373	741,151
1950–1960	4,065,576	211,614	2,350,448	919,717	1,163,909	1,191,469	434,501	1,095,326	313,658

Increase of Urban Population, By Decades (in Per Cent)

1900–1910	89.0	130.6	80.1	39.3	33.0	33.4	34.3	45.9	35.7
1910–1920	58.5	27.1	61.2	68.9	26.5	38.0	22.5	30.1	19.5
1920–1930	78.8	25.5	58.0	47.3	28.0	22.6	15.2	32.4	22.5
1930–1940	17.8	8.6	21.8	4.6	3.1	2.3	0.8	1.7	6.1
1940–1950	47.1	37.7	58.4	20.6	11.7	15.9	6.1	15.4	6.6
1950–1960	56.4	28.9	51.0	22.1	17.9	22.3	6.2	28.0	2.6

and 1930 was exceeded only by New York, and then only by a modest margin. For the decade from 1930 to 1940 California had the greatest absolute increase in urban population, although somewhat behind newly urbanizing Texas in percentage increase. Given such large increments to California's urban population in the automobile era, it is obvious that there must be a close relationship between city expansion and increases in car ownership.

The tie between car ownership and California's urban boom was direct in many cases. In fact, it is doubtful that the rather conflicting elements in the state's housing picture in the 1920's could have been reconciled without near-universal ownership of cars. To begin with, there was the great inflow of people whose housing needs could best be cared for by individual bungalows, which had come into style as the "average man's" house by the end of the First World War. Along with this went an inability, in most cases, to expand the trolley lines to any great degree, because of the collapse of financing. This was particularly the case in the poorer housing areas where it was often reasoned that the patronage would not even repay the capital cost. Thus, not only the well-to-do, who would have had automobiles in any case, but also the lower income groups came to buy cars. Once the housing location decision was made on the basis of car commutation, many areas that had been left open for want of trolley lines were thrown into the housing market. The bungalow tract was made practicable by the almost universal ownership of automobiles in California.

Filling the Holes in the Urban Structure

In the Bay Area a number of sections grew rapidly at this time. Albany, Daly City, El Cerrito, Hayward, Piedmont, Redwood City, San Leandro, and San Mateo more than doubled their individual populations in the two decades of 1920–1939. The older towns, which had grown up under the trolley wire to a considerable degree, increased their populations more modestly. Alameda, Berkeley, Oakland, Richmond, San Francisco, and San Rafael grew by considerably less than one hundred per cent between 1920 and 1939. Yet, even in the older towns sections had been left vacant by the initial urbanization. Areas like Kensington in Contra Costa County came rapidly to town stature in the 'twenties and 'thirties. Growth of the Sunset District of San Francisco was certainly not solely dependent on the improvement of trolley service in the early 'twenties, because many parts of the Sunset were far removed from the lines. It seems that in most parts of the Bay Area, the automobile led to the filling in of areas that had been left vacant for one reason or another.

Areas especially prone to summer fog provide one of the more unusual causes of empty pockets in the settlement mesh. The Sunset District of San Francisco is one of these, and the crest of the Berkeley Hills in El Cerrito, Kensington, Berkeley, and Oakland is another. In the Sunset District the indraught of air from the Pacific brings fog at ground level. In the East Bay the partial shelter provided by the hills of the San Francisco and Marin peninsulas caused the fog to be absent near sea level in the "flats" in Berkeley, Albany and Richmond. But in the hills the low stratus cloud "deck" developed at elevations somewhat below the crest. Although no precise bottom of the cloud deck can be given, in Berkeley summer fog is more frequent from around five hundred feet upwards.

This phenomenon limited housing development until fairly recently, probably for two reasons. The first was that many people did not particularly wish to be shrouded in low clouds during the summer. Second, lending institutions projected this dislike on the part of some people to the proportions of a general dislike, reasoning that houses in the fog deck would be hard to resell. Time proved this to be very wrong, but it appears that it was largely the federal guarantee of mortgages in the late 1930's that relieved the hilltops from the building embargo enforced by mortgage institutions. Also these heights were at the edge of the city, and thus in the least profitable location for the operation of public transport.

But the edge of the city was so steep and high that it was impracticable to live there without some means of mechanical transport. The trolley lines in Berkeley, for example, ended on Euclid Avenue near Marin Avenue and on Arlington Avenue at the Contra Costa County line; the projected cable car had never been built up Marin Avenue. Only with the coming of the automobile was it possible for many people to climb well above these termini. In the automobile-developed area above Euclid and Marin avenues, the "paths" typical of earlier times disappeared, because residents were not dependent on the trolley when the houses were built.

The housing pattern in the Bay Area at the outbreak of the Second World War had several "form elements" that might be related quite directly to the spread of automobile ownership and use. Two of these elements were the small holder summer-camp tracts, where the car first became fundamental to the life of the area, and the filled-gaps in the settlement fabric that existed before autos assumed importance. Obviously, neither of these parts of the housing structure was an expression of the ultimate use that could be made of the automobile in the commuting life of the city. Although people who lived in the Sunset District might drive to work, the Sunset was not basically an automotive suburb.

And this was true of Kensington, El Cerrito, or Hillsborough. Each of these places was highly ambivalent in its tie to the workplaces in the Bay Area. For the bank employee or investment counselor, the interurban or SP Peninsula Line might be the logical and ultimate form of transport. But the plant manager who lived next to him might consider driving the only sensible way to commute.

With the introduction of mechanical transport, the close workplace-residence ties were broken, and strong links developed among various business establishments and among residents having similar economic and social orientation. The distinction of a town like Piedmont was not the location of its residents' employment, but rather their level of income expectation. And conditions were similar for a mill village such as Crockett, although within a different income expectation stratum. Thus there was an increasing diversification of workplaces as autos came into use. Local people were able to seek work in a wide range of locations. And both Piedmont and Crockett chose public or private transportation largely in terms of workplace, not occupation or cost.

War Breaks the Urban Tradition

Because World War II intervened at such an important juncture in the evolution of the Bay Area, the hiatus had great reality. By 1945 the population had grown sharply, largely through an influx of people from other parts of the United States who came to employment in non-traditional occupations and workplaces. Montgomery Street was, in functional terms, a backwater of interest or growth during the war. The shipyard worker, if he carried any expectation of the culture and landscape of California, brought an anticipation of the common man's California, which was essentially the life and landscape of the Los Angeles Basin. The conservative and inner-directed Bay Area provided an answer neither to his settlement nor his social aspirations. To the easterner the Bay Area had a vivid environment but a pale and hesitant culture. For the southerner it had a too-formal society but a nice climate.

After a time each of these immigrant groups came to have its own milieu in the Bay Area. The eastern city man found post-war San Francisco had figuratively and geographically moved closer to the center of American letters, while the former southerner from Louisiana or Texas, resident typically in Hayward, Sunnyvale, or Concord, molded those places so they became almost indistinguishable from parts of the Los Angeles Basin. But there were very many more blue collar workers, with the more material southern California aspirations, than there were eastern book publishers, who might wish a West Coast Greenwich Village. Thus the transformation of the Bay Area came mainly in terms of

vast areas of socially indeterminate housing tracts rather than in the creation of many tradition-liberated Sausalitos.

The Second World War was, in many ways, the "take off" period for the Bay Area. The production of war material and the staging operations carried on here brought an economy and consumption pattern that departed sharply from the classic California pattern. Most of the industries entering the area were desirous of modern plants and paid high wages. In electronics, missiles, research and development, and other typically Bay Area industries, there was so little association with pre-war industrial sites that the emphasis in plant location became peripheral rather than central. This, along with the influx of workers coming specifically for the "growth industries," meant that the traditions of residence-workplace ties did not affect large segments of the commuting population. Almost without exception the result was the establishment of an automotive journey-to-work, and the creation of large housing tracts peopled to a considerable degree by recent arrivals.

Because large segments of the Bay Area population were unaffected by traditions and long-run judgments as to residential values, the housing tracts that developed tended to be highly class-stratified. This was shown euphemistically by appelations such as "executive homes," "homes for junior executives," "luxury homes," and "a community for gracious living" that stand for some sort of rank-order of tracts and generally appear in newspaper or billboard advertising of housing developments. Needless to say, our democracy has been thought to require the substitution of "community for gracious living" for what might in sociological consistency be called "blue-collar homes."

In each major section around the Bay there will be a fairly complete range of tracts as exemplified by the "continuum" east of the Berkeley Hills which progresses from Pacheco and Pleasant Hill in the north with their "gracious living" to the "executive estates" in the south at Mt. Diablo. The scale of these economic-class tracts is large in many cases, indicating a regional support rather than a local one. This in itself tells us that the post-war tract is a very different thing from the housing that was built before 1939. Most pre-war housing was rather clearly tied to a specific work area, but had a tendency to be less uniform in price range than is true of post-war developments. Over the years an increasing range of housing locations appears to have strengthened stratification. *We know that for most people the journey-to-work is fixed not so much by conscious decisions concerning workplace, as by very rigid criteria for living place.* The rigidity is reinforced by the strictures imposed by class-oriented tracts. The combination of prospective house buyers with strong views as to home location, and a housing industry whose building

is strongly class-oriented, can be possible only in a society that has high locational mobility due to the use of individual transportation. And since the Second World War most families that have bought houses have done so completely on the basis of auto commuting.

The New City

The Bay Area has become the region of the *new city* to a degree matched only in other parts of the Far West and exceeded perhaps only by Los Angeles. This new "city" differs in both scale and functional structure from the metropolis of pre-war days. In the beginning, Bay Area settlement was concentrated in San Francisco and in the several "embarcaderos" intimately linked thereto. This was an urban form characteristic of the early industrial age. Industry gave the city its population size. Dependence on highly localizing transportation imposed the area scale. When transportation was improved, the area scale increased through the separation of living-place from work-place and the metropolis came into being. But the metropolis still depended upon predictable movements and the focussing of travel for mass transit. The introduction of individual transportation—the automobile—began to reshape the settlement at its edge.

With the increasing ownership of cars, there was a strong tendency to seek an alternative to mass transit. Mass transit was not expanded significantly during most of the last fifty years. This meant that land "brought in" by the introduction of the trolley and interurban lines had already been developed before the great growth in the Bay Area took place after the Second World War. When economic expansion came rapidly after 1945, it was necessary to turn to the car. This created an urban pattern that was only partially channeled into routes. The freeways enforced some "control" of expansion, but they tended to respond to demands, rather than to open new land as had the trolley in many cases. The freeway tended to come "after the fact" so there was, in its *delay,* a force leading workers and plants to seek outlying sites for both termini of the journey-to-work. The 1960 census showed that the greatest single movement of workers was from one outlying area to another, rather than from the periphery to the core. The new city had become *non-centric.*

This non-centric city neither seeks nor flees from the center. Rather it disregards it. The creation of the factory made cities centripetal, as Charles Colby clearly saw three decades ago.[88] The dangers stemming from concentration encouraged the centrifugal efforts of Adna Weber, Ebenezer Howard, and many planners. Only very recently and in the writings particularly of Lewis Mumford and Jane Jacobs, has the return

[88] Charles C. Colby, "Centrifugal and Centripetal Forces in Urban Geography," *Annals of Association of American Geographers,* 23:1–20, March, 1933.

cycle been proposed.[39] This ebb and flood is related, however, to a doctrine more than to an actual need. So long as men in the mass had to travel on foot, the city had to grow primarily through congestion. With railroads, continuing compaction took place and led to increased city size. This deadly congestion induced a strong reaction. Then the trolley came at the same time that important improvements in public health had begun to make the city core livable. But by 1900 it was already fashionable to move out, so all tried to do so. Now the recent contrary thesis of Jane Jacobs would recreate the conditions of the congested city in the belief that peripheral growth has served to increase waste and the cost of living, and has contributed little to life's greater enjoyment.

It is fashionable, if extremely trite, to refer to the urban area as a shapeless sprawl, as a cancer, as an unrelieved evil. In this view we have the double assertion that (1) the city today has lost its structure, and (2) that there is a specific structure that will be best for a city, or cities in general. The combination of these two attitudes makes it almost impossible to look at this matter with any degree of analytical objectivity. To begin with, it should be clear from this examination of the Bay Area metropolis that there is a well developed structure, even of the rapid peripheral expansion that has taken place since the Second World War. The erroneous assumption that no such structure exists must result from a failure to study the dynamics of urban growth, or possibly from the desire to put forward a doctrine of what is "right" or "good" in urban growth. In the absence of a study of urban dynamics, the assertion of the "right" solution must be based on dogmatic belief rather than understanding.

Let Us Return to the Eternal Verities

There appear to be several groups from whom it is logical to expect a strong statement of belief as to the rightness of increased concentration at the center of the city. Those whose business or financial interests turn toward the core of the city—downtown San Francisco and Oakland in this case—may argue that peripheral spread is "undesirable." As we have noted, the two frontiers for land speculation lie at the center and the edge of the city, respectively. In recent years urban dynamics has led almost automatically to an appreciation of values at the edge of the city. The appreciation has been far less "automatic" at the center, so it is understandable that speculators owning central land might wish to reverse trends.

The second group for whom peripheral growth is anathema is united

[39] Jane Jacobs, *The Death and Life of Great American Cities,* New York: Random House, 1961.

by a psychological rather than financial interest. This is basically the group of people for whom the specialized social milieu of the professional intellectual is important. Artists, architects, designers, planners, musicians, and writers, along with the secondary and tertiary occupations stemming from true creativity, all tend to generalize their individual views of the city from the need they experience for a closely settled ingroup of style and "taste." In this manner Jane Jacobs or a planner can assert that suburbs are "bad," even "mentally degrading" because their own creativity would be stifled in a Levittown. As John Canaday commented recently in recounting the end of a century-long marriage of the state of Maine and the American artist, "What with air-conditioning there is no need for a painter to summer in Maine unless he needs the stimulation of its landscape as a point of departure. And few artists do need it, since talking has long since replaced looking as the abstract artist's creative stimulus."[40]

It is understandable that the professional intellectual, with his need for salons and group fertility, or the downtown investor and worker, with his hope for subsidized commuting, should believe that a reversal of the trends in urban dynamics should be sought. It is surprising, however, that they have been so successful in giving those for whom the center has no direct importance a sense of guilt in their choice of a suburban life, as well as a sense of debt to the downtown worker. This appears to result in considerable measure from the fact that the groups in our society whose job it is to speak—the writers, commentators, and publishers—believe with sincerity that the city core is the city *heart* because only there can the man in the communications industry find his own stimulus and livelihood.

In the same way, the honesty of the downtown businessman cannot be impugned. But his knowledge can be questioned. We have the right to ask that he demonstrate the truth of his words as well as his strong belief in them. There have been far too many "loaded" pronouncements from those in the communications industry and from those with personal downtown interests. Until additional evidence is produced to the contrary, it seems more objective to put forward the view that the outward growth of the city is neither cancer nor unstructured sprawl, but the result of economic and social attitudes that are centrifugal with respect to the city. In any event these trends are far less obviously a rationalization of narrow self-interest than is the call back to the forum issued by newspapers and intellectual arbiters.

To examine this proposition that the city is in fact a healthy organism,

[40] John Canaday, "A Show From Maine at the Whitney Museum," *New York Times*, February 11, 1964, p. 45.

we must go back to look at the city that grew in the early industrial era. Then we find that the great increase in economic activity—consequent upon the take-off of the industrial revolution—required a thicker settlement fabric than that which characterized rural activity. The result was first the mill village and ultimately, as in Oldham or Ashton-under-Lyne, a grouping of mill villages. The grouping did not cause congestion *per se;* rather it led to the efficient organization of an *industrial region* with villages producing different products that were related one with another. Thus the villages were integrated into an industrial region. These regions ultimately became cities or conurbations. The absence of a technology permitting great growth in production without *residential congestion* was the failing of the mid-nineteenth century. The evil came from the rise of industry prior to the growth of personal transportation.

Subsequently we have secured a form of transportation that provides adequate individual commuting as did walking in the mill village. This is the use of cars within a particular sector of the city to allow the workers (1) to live under conditions that are not congested, and (2) to avail themselves of alternative job opportunities. The mill village has been replaced by an *urban realm*—a major sector within which the worker can live in physical comfort, and where he has the chance of improving his lot by making his labor a scarcity. Those who staunchly put forward the idea that the worker must live next to his work should reflect on nineteenth century Lowell, Massachusetts. Wages there could be depressed very easily because no housing was available under the "Waltham System," except to those who worked in the adjacent mill. It should be emphasized that what happened subsequently was *residential decongestion* through the agency of the trolley, which in turn led to *industrial decongestion.*

Today the automobile metropolis has workplaces in most of its parts. Growth throughout the city has come from the creation of urban realms to replace the land-use zones devised just after the First World War. This change is no cancer, it is the growth of a healthy organism. Any attempt to force the city to function as if there had been no fundamental structural change since the trolley era, is the utmost of folly and can only be characterized as quixotic.

The Urban Realms of the Bay Area

The traditional view of the city includes a central core around which economic activity concentrates. Retail trade, particularly in department stores, wholesale trade, and manufacturing are central activities, while the edges of the metropolis are given over to residential use until some sort of front is reached where the metropolis is pushing into the country. The influence of the city is also felt farther out, in a broad zone that has recently come to be known as exurbia. This conception of the city views it as highly *centered* and spreading outward in zones of decreasing density and dependent economic status.

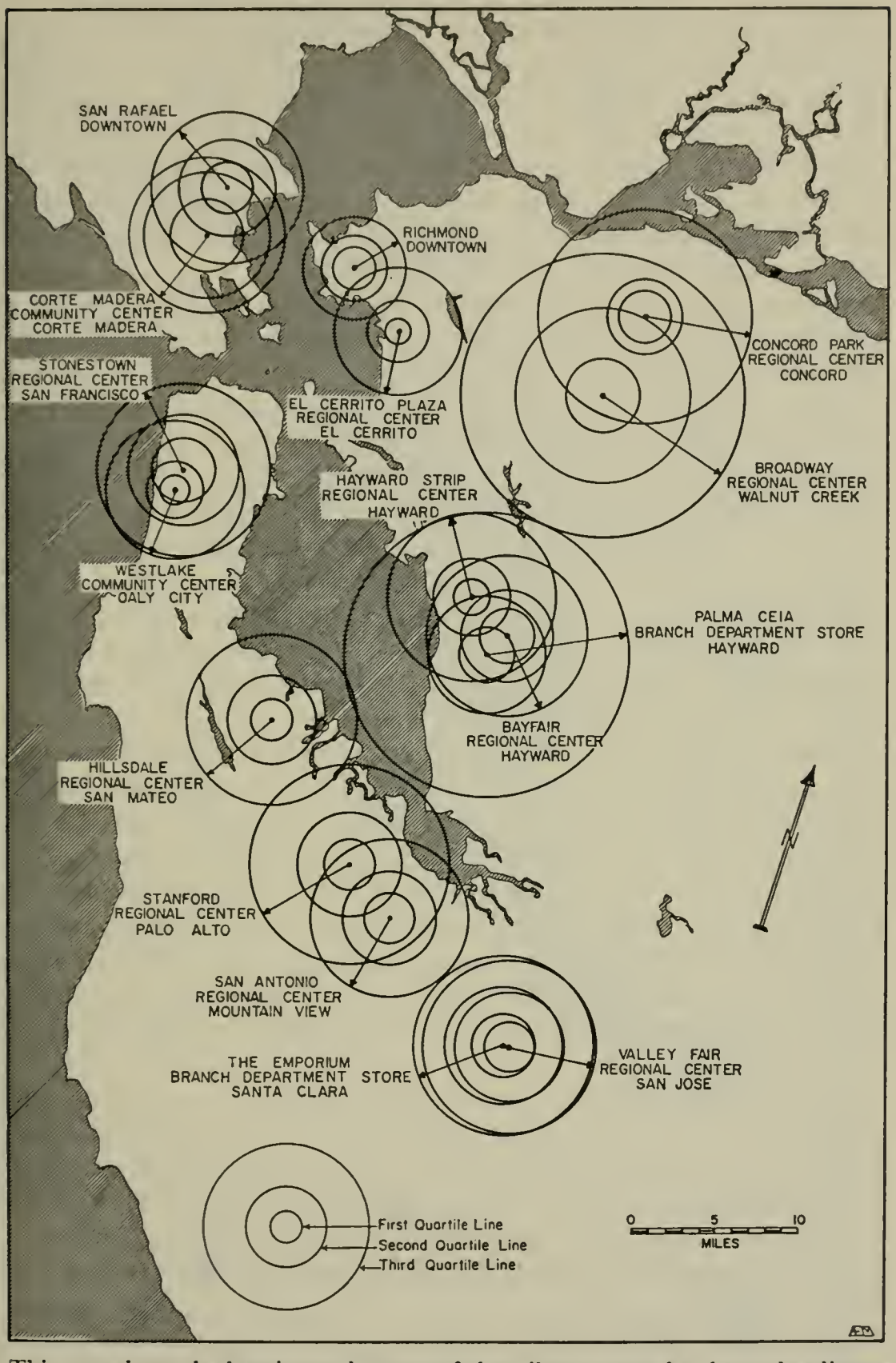
When we attempt to apply this concept to the Bay Area we find so many discrepancies that we must re-examine the traditional conception of this region as being "centered." From such a look, and the development of the Bay Area that we have sketched, it seems apparent that the region is *non-centric,* having a number of internally-functioning urban realms rather than the single unit that tradition proposes.

This is not the place to put forth all of the evidence underlying the non-centric view of the Bay Area metropolis, but some evidence should be cited. In the traditional or centered concept of the city, economic activity—particularly in trade as opposed to manufacturing—clusters at the core of the metropolis. To test the concept of urban realms as demonstrated in retail trade we may look briefly at the present-day commercial structure of the region.

The Bay Area is typical in that its retail trade divides hierarchically. There are several central business districts—in San Francisco, Oakland, and San Jose—and there are a number of regional shopping centers carrying on business similar to that of the central business district. Below these major trading centers there are older places and integrated shopping centers that serve communities and neighborhoods rather than major segments of the urban area. The smaller shopping places serve needs in food, basic clothing, drugs, and other regularly repetitive wants. Quite obviously they divide the region into small highly localized tributary areas that tend to be mutually exclusive for the individual shopper.

In the Bay Area, there were no regional shopping places other than central business districts before the Second World War. Since 1952 when "Stonestown" was opened in San Francisco's Lake Merced district, eleven regional shopping centers have been constructed to undertake much of the retailing that formerly was restricted to the city cores. *The result has been the truncation of central districts.* The standardized

Map 8: Outlying Shopping Centers of the Bay Area, 1959



This map shows the location and nature of the tributary area for the twelve discrete regional shopping centers in the Bay Area, as well as several community centers and downtown areas of older satellite towns. The three concentric circles centered on each shopping area enclose the residence of (1) the nearest quarter of the customers of that center, (2) the nearer half, and (3) the closest three-quarters of the customers, respectively, Thus, the space between successive quartile circles helps indicate the density of customer-residence. The radial spacing of the circles shows the peripheral extent of the tributary area. From this graphic summation of tributary areas we find that the Palma Ceia Center in Hayward has the greatest radial extent, whereas the El Cerrito Plaza has the most restricted tributary area.

shopping functions have been pruned away, leaving the cores with three functions: (1) they serve as the area of standardized shopping for people living in and near the core; (2) they serve as a shopping place for this sort of goods for those people who work in the central business district; and (3) they carry on certain highly specialized retail functions for the metropolis. Only in the last case, it should be emphasized, does the central business district continue its former, and traditional, function of selling to the entire urban region.

This truncation of function has allowed the growth of outlying shopping centers. The map shows the result of a 1959–1960 study of tributary areas for the eleven centers in the Bay Area.[41] It is fairly obvious that these centers "parcel out" the area into mutually exclusive realms, much as have the neighborhood and community centers throughout their history. Because the eleven regional centers account for more than half the general merchandise shopping of the Bay Area, it is fair to say that the centered view of retail trade is unwarranted.

Next, we can test the existence of wholesale trade realms. A recent study located and classified all wholesaling establishments in the Bay Area. The map shows only the general locations of important clusters of wholesaling establishments.[42] The pattern is striking in two respects: (1) there are *many* wholesale districts, not merely one at the center, even if the center be so defined as to include both Oakland and San Francisco; and (2) there is considerable specialization within wholesale districts so that some types of trade are poorly represented in the central cities. Specifically, we find that in food-wholesaling the previous importance of San Francisco has disappeared with even the produce markets moving outside the city (save for a minority group). And in certain types of wholesale trade, notably in pharmaceuticals, the Bay Area's rise to a position of regional importance, nearly on a par with Chicago and New York, has seen the location of wholesale establishments well outside the two core districts.

In terms of industrial development, the Bay Area has always comprised several realms rather than a single core. We have noted that early in the history of the area the existence of the Bay gave to all its embarcaderos nearly equal access to the sea, leading industry to disperse widely over the area. Recent plant locations, such as in electronics at Palo Alto, missile development at Sunnyvale, business machines at San Jose, and

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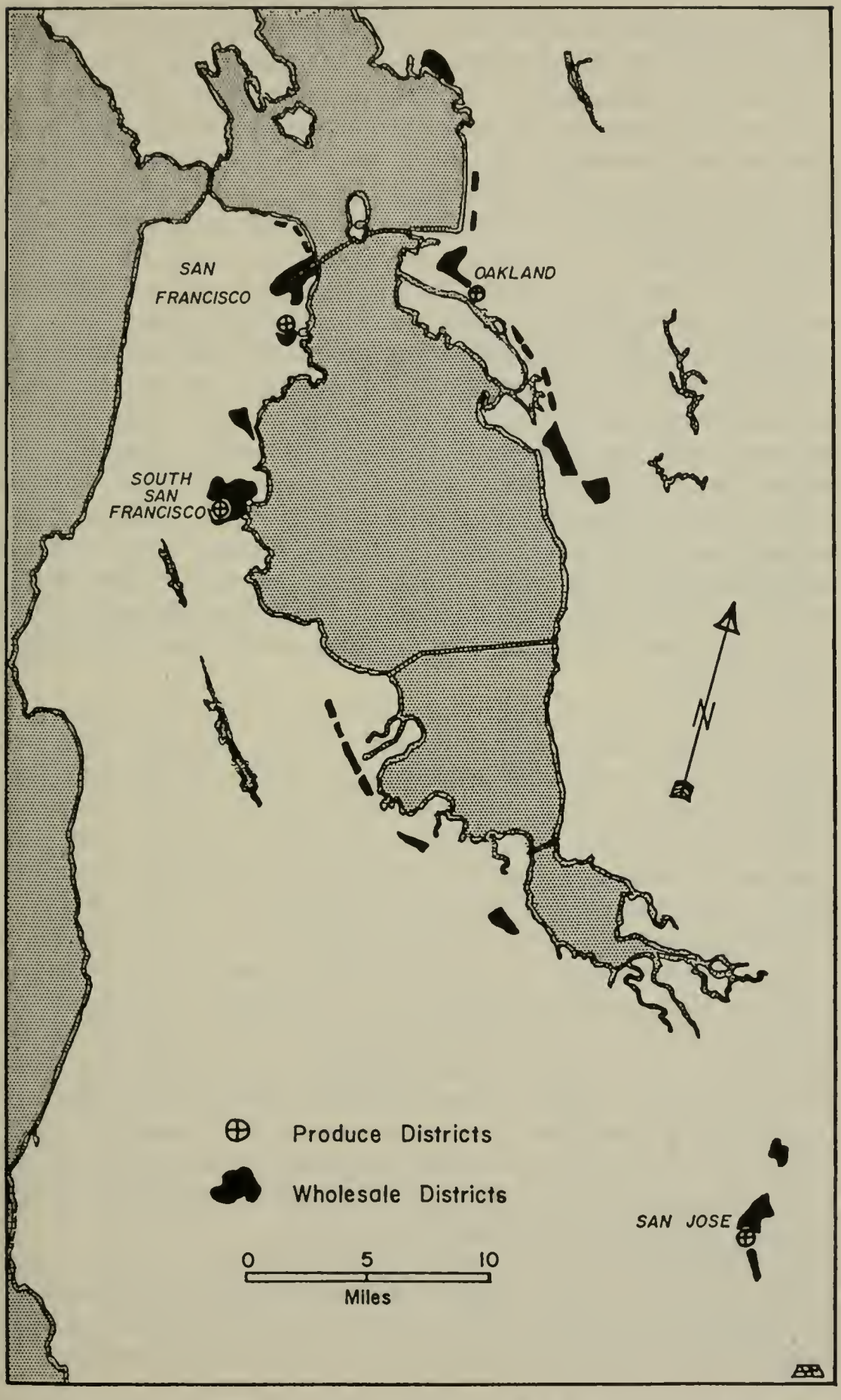
[41] James E. Vance, Jr., "Emerging Patterns of Commercial Structure in American Cities," in Sweden, Royal University, *Proceedings of the I.G.U. Symposium in Urban Geography*. (Lund Studies in Geography, Series B, Human Geography, No. 24, 1962) p. 485–518.

[42] Detailed findings will be presented in a forthcoming book by the author. This study was supported in part by the Center for Research in Real Estate and Urban Economics, University of California.

Map 9: Wholesale Trade Districts, 1964



The linearity of wholesale trade districts may be noted, as well as their wide distribution throughout the Bay Area. The utilization of four separate produce districts in supplying perishable products to the Bay Area metropolis is unusual.

atomic development at Livermore, have accentuated a pattern of long duration. These new plants are so far from the core cities that they exist in closed or nearly self-contained journey-to-work areas. The evidence from the 1960 census on the commuting patterns in the Bay Area shows that the most common journey is from one non-central area to another. Again the detailed evidence favors the view that the area is comprised of realms, rather than a metropolis whose daily focus for the average man is at the core.

Only in certain types of office function is there strong evidence of continuing centralization at the core. Donald Foley found that considerable functional convenience is derived from office concentration in the San Francisco financial district. For certain central banking and financial functions, the Montgomery Street cluster is a vital structure. But even in this regard it should be noted that major office functions may exist away from "the street." Kaiser Industries in Oakland, the State Farm Insurance Company, formerly in Berkeley but now in Santa Rosa, and the Stanford Research Institute in Menlo Park, as well as a multitude of business and scientific activities associated with research at the University of California in Berkeley, all prosper beyond the confines of the structural unit focussing on California and Montgomery streets in San Francisco.

For those outside its limited occupations, the financial district is merely one of a number of realms, and no more important than any other. *This fact is not as well understood by the financial district power elite as it should be.* Those who work in the financial district command special attention, both by their own substance and by their ties with news media, and make important decisions on the assignment of capital among competing demands within the metropolis. Thus they have a great responsibility to try to understand correctly the functional geography of the city. Historians and historical geographers of the future will, with complete justice, note as a tragedy any confusion by this power elite of their parochial interests and the interests of the metropolitan area. The provision of subsidized transportation for financial district workers makes no more valid call on the city's total resources than does the provision of subsidized transport to assembly plant workers. To use power within the urban society and economy as a justification for an enlargement of that power denies to the group concerned any honorable claim to the designation "elite."

There has been a major reconstitution of the Bay Area. This fact is clearly understood in the vernacular. When we seek to give a geographical designation to Boston, which shares many characteristics with San Francisco, the most important of which is that it is more a collection of

towns than one town, we must fall back on "Boston" even if we mean one of the suburbs. But in San Francisco we can and do say the "Bay Area" when we wish to distinguish between "the City" and the region. No longer can the Bay Area be considered conterminous with San Francisco in terms of either *area or culture.*

San Franciscans are those who both work and live in the city itself. San Francisco stands almost alone among American cities in preserving the view that to live in the central city is a desirable thing. We should applaud this. But San Francisco must mature a bit and learn the distinction between a cult and a principle before we can stand many such cities. The author has been a Bostonian, although he probably never spent a full night inside the city limits. This is possible because one may be a "Bostonian" while having only cultural ties with the central city. But the author is not a "San Franciscan," and could only become one by considerable reorientation of his life. This, in a personal but no less real way, serves to show that the "Bay Area" is a generic place rather more clearly than most modern urban areas. No doubt the Bay and the scale of the place make this collective life more obvious. But the mind of the "San Franciscan" also plays its part by carefully defining its geographic peers. In the meantime the Bay Area has grown to maturity as a collection of realms, only one of which is San Francisco.

Conclusions

The present physique of the urban area represents a structure one stage beyond that of a metropolis. It is a collection of realms that form a "city" in its broader meaning. At this point it is well to distinguish the city of realms from the "conurbation" sometimes ascribed to the Bay Area. Conurbation is a clear term referring to a specific dynamic. When a resource has a relatively widespread occurrence, let us say a coal field or the Fall Line[43] in the eastern United States, it tends to cause the development of a number of towns created to exploit that resource. Although such places are initially independent, economic growth brings about their physical union in a large urban region whose composition is the joining of parts.

Manchester or Birmingham (England), for example, is merely the most important place in such a conurbation. It might at first seem that the Bay Area is a kind of conurbation, one which surrounds and shores the Bay. But the history of Bay Area settlement reveals one critical difference: here we are concerned with development by stages, not with a shared resource alone. The Bay Area has not grown together, rather it has grown apart. The germs of the present pattern were planted at the time of the Gold Rush; but only with the technology now available, and the population and economic growth of the post-war years has the pattern emerged. The Bay Area is not a larger San Francisco; it is the latest in the stages of urban existence around the Bay. San Francisco was merely the first of these stages, followed by the Venetian city, the trolley metropolis, and the automotive city of the late 'twenties. Today the city-of-realms is a fifth stage, with some features unrelated to the four stages that preceded it. Unlike the conurbation, the lineaments of the city-of-realms are fully established only in its own time.

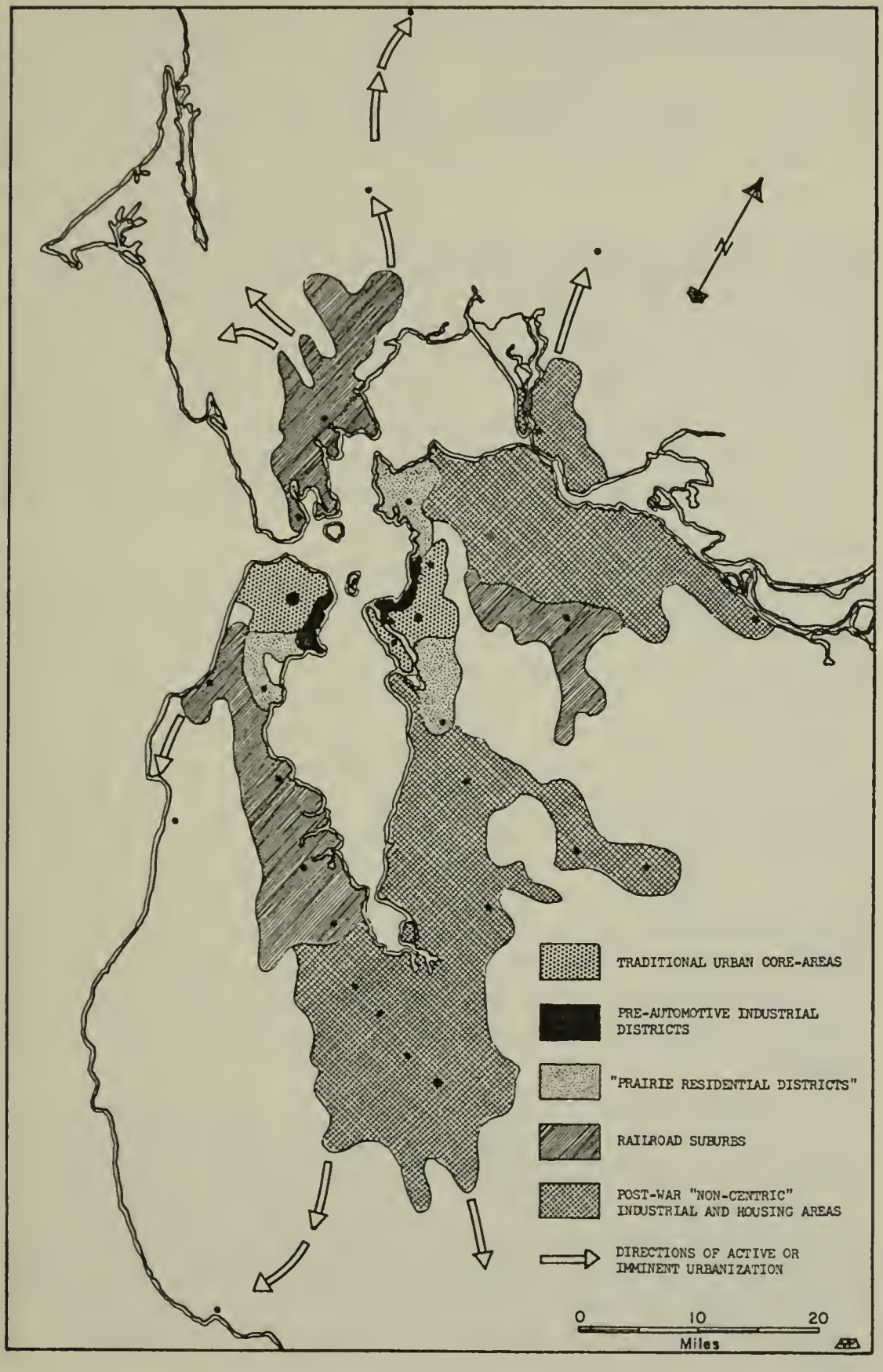
The first description of the Bay Area's components should be a map. From journey-to-work information in the 1960 census, and from evidence of the geographical pattern of retailing and wholesaling, it is possible to establish a rough delineation of the urban realms of the Bay Area.

San Francisco

The City of San Francisco is the historic core of the region and still

[43] The Fall Line is the alignment of "falls" or water-power sites generally at the innermost reach of tidal flow, or possible oceanic navigation, on rivers flowing to the Atlantic coast of the United States. Because ports and industrial towns came into existence at these falls (from Lawrence to Montgomery) there is a long string of towns along the Fall Line from Massachusetts to Alabama.

Map 10: The Realms of the Bay Area Metropolis in 1964: The Non-Centric City



its center for "traditional activities." Thus, the financial district serves as a center for a considerable amount of employment in office activities. Reliable data are unavailable, but it appears that employment in the financial district is increasing less rapidly than the total employment of the Bay Area. This district is also probably becoming more highly specialized. Turning more to banking, legal services, investment and brokerage activities, San Francisco is the site of a sort of work that still requires face-to-face association of representatives from many different firms on a very frequent schedule, or the collection of large numbers of clerical employees. Those functions that can be automated or made susceptible to handling through a computer may well be moved out: the Bank of America for example, has shifted some of its check-handling facilities from San Francisco to the warehouse district of Berkeley. Although there are forces causing additions to the financial district, there seem to be nearly equal forces causing dispersion of activities. Thus, it appears that the growth of the financial district will lag behind that of the Bay Area as a whole.

The shopping functions of San Francisco have shown a progressive concentration of specialty goods; consequently, the number of shopping journeys per family per year has almost certainly dropped. The growth in retail sales in the Bay Area has been entirely external, with the San Francisco central business district merely holding its own when we use an index of "constant dollar" purchases rather than absolute sales. The result is the creation in downtown San Francisco of a shopping district that has become progressively more a specialty district, with the traditional mass selling still provided primarily to those people who live or work in the city itself. With the relative decline of San Francisco as a shopping center, and the decrease in commercial entertainment (such as movie theaters), the retail-amusement district has become relatively stable. What growth has taken place seems to relate largely to the tourist and travel industry. Union Square has become, like its Los Angeles analogue, Pershing Square, particularly noted for the array of travel offices.

The one exceptional feature of San Francisco is the continued use of the city as a residence for middle and upper income groups. Unlike most central cities in the United States, San Francisco has managed to retain these groups and has, in addition, added a considerable in-migrant group possessing a good deal of skill and education. The retention of an educated and economically prosperous group in the oldest city has made San Francisco more like New York than most of our cities—having a significant in-town entertainment and restaurant district.

The San Francisco Realm is then largely an administrative and fiscal one. Retail trade, manufacturing, and wholesaling are all less concentrated in the city than formerly. Only commercial amusement and restaurant functions prosper as before, and then particularly in relation to the resident and visiting administrative and fiscal population.

The San Francisco Suburbs

All residential development in the Bay Area should not be equated with suburbs of San Francisco. As we have seen, satellites developed early, having only infrequent contacts with the central city. These core links for some parts of the Bay Area are probably less strong now than they were thirty years ago. But the ties have grown in a number of directions from San Francisco. The map of the journey-to-work shows that daily ties to the core city are strong in the upper San Mateo peninsula and in the Marin peninsula. Thus, we may think of the San Francisco suburbs as the "Two Peninsulas." On either of those promontories that face each other at the Golden Gate, core-city employment is dominant throughout most of their length. The absence of important alternative sources of employment, the late development of these areas, and their general isolation have all contributed to a domination by San Francisco. Therefore, these peninsulas are peopled by administrative and fiscal workers, but with a considerable sorting which has tended to leave the lower-paid employees in the central city or in its close-by suburbs, such as Daly City, San Bruno, or South San Francisco. The links between the Two Peninsulas and the Traditional Center are strong. They share a common support and a similar outlook. These are the areas of the most firmly held San Francisco traditions.

San Francisco dominates the two peninsulas throughout the Bay side, but on the ocean side the exactions of the foggy and windy climate reduce the proportion of the population working in the city. Both in Marin and in San Mateo counties the ocean-slope has tended to remain more in agriculture, particularly on the raised coastal terraces whose relative flatness encourages field-crop agriculture. Artichokes, Brussels sprouts, mushrooms, and heather thrive in San Mateo as fog-zone crops. In Marin the absence of pronounced coastal terraces, and the consequent protection of valleys opening onto the ocean, has caused dairying to replace field crops, save in a few small patches of alluvial soils deposited in the still waters of bayheads. On either peninsula the tendency for landslides on the seaward side has also discouraged suburban development. This is notably true in San Mateo County south of Montara Mountain. Although physical isolation may not result from such a slide, the circuitous commuting it may require is sufficient to discourage suburban residence.

Only slightly and peripherally has local employment come into the two peninsulas. The portion of San Mateo County adjacent to the Santa Clara Valley has turned increasingly toward employment in the valley. Such a trend is probably encouraged by the existence of a separate focus of activity at Palo Alto which has, since the Second World War, become a manufacturing center for electronic products. The presence of Stanford University has been responsible for industrial growth.

Only now, and to a very small degree, has the Cotati Valley north of Marin County experienced a quickening of economic activity. In the long run, however, there seems no obvious disqualification of the Santa Rosa area for development similar to that in the Santa Clara Valley. Such an event should accentuate the trend that is already discernible even in these staunch San Francisco suburbs: the creation of outlying foci of interest. The San Mateo peninsular area has its full share of outlying shopping centers; Marin County lags, although it probably will not do so for long. The San Mateo-Santa Clara area has burgeoned in "growth industries," giving a focus of livelihood different from the traditional one in the core city, while Marin has no alternative to the city. But in the long run this seems a condition just-before-change rather than one of stability. In any event the agriculture of the two penisulas can be considered ephemeral. Some sort of development restriction would be required to preserve it.

The East Bay Core

To the outsider, the traditional San Franciscan, or the romantic, the Bay Area appears to be single-centered and ruled by San Francisco. This study has shown that the traditional view has long since lost much of its validity. *The East Bay is a metropolis in its own right,* a fact that needs to be asserted forcefully.

The East Bay came into existence as part of the larger metropolis at the very beginning, and soon began to undertake functions peculiar unto itself. In heavy manufacturing, in heavy warehousing, in transportation, and in education, it early became dominant, leaving San Francisco in a dependent position. But to the lay mind, these functions

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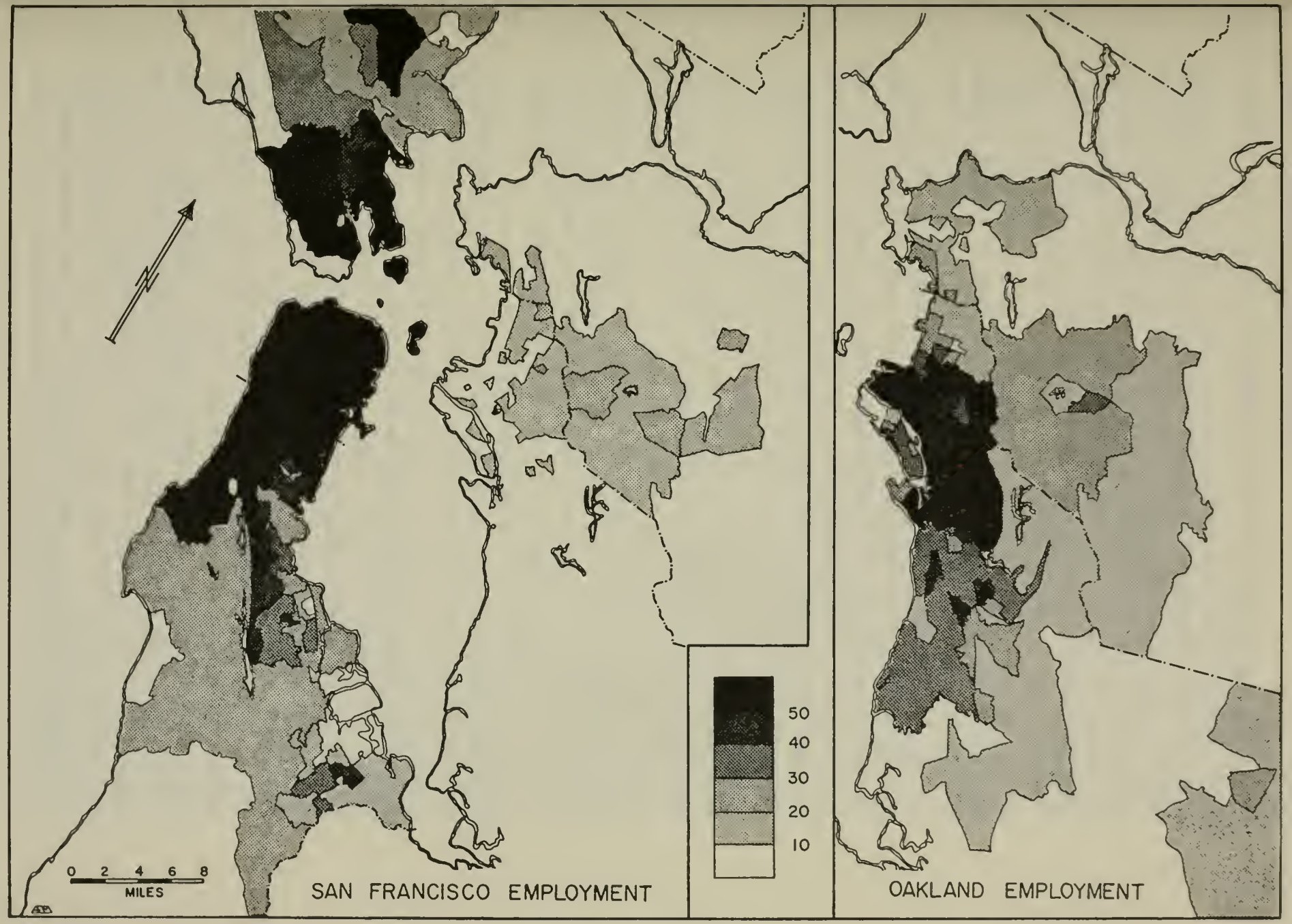
The left-hand map shows the percentage of the working population in each census tract who are employed in San Francisco. In southern San Mateo County, a large employment outside the San Francisco-Oakland SMSA has been subtracted from the total work force before figuring percentages. This was done to single out the "pull" of San Francisco as opposed to employment sources elsewhere within the SMSA. The right-hand map presents a similar analysis for employment in the City of Oakland. The complementary nature of the two patterns may be noted. Data are from journey-to-work information in the 1960 census.

MAP 11: SOURCES OF SAN FRANCISCO AND OAKLAND EMPLOYMENT, 1960



See legend on page 82.

are not the key *urban* ones, so the East Bay has suffered slight and derision it does not deserve.

A look at the journey-to-work information in the 1960 census finds Oakland both real and relatively independent. When measured by the same yardstick of "employment field,"[44] San Francisco and Oakland stand largely as reciprocals of each other. The Two Peninsulas are related to San Francisco as the East Bay is oriented to Oakland. This generalization is basically valid, and quite specifically so with respect to the functions that Oakland and San Francisco share. Thus, those residential areas where industrial, warehousing, or transportation workers live are divided into two groups by the Bay. South San Francisco houses San Francisco workers, while San Leandro serves Oakland.

Only in those areas that house administrative and financial workers and their sort, is San Francisco of importance in the East Bay. A few areas in North Berkeley and in the Claremont District turn more strongly to San Francisco than to Oakland. And the district with higher summer temperatures that lies east of the Berkeley Hills looks to San Francisco as an important workplace—but the region is still drawn more to Oakland than to San Francisco. The existence of significant commuting to San Francisco has led, however, to considerable popular confusion. For many people the congestion in the Caldecott Tunnel through the Berkeley Hills appears to be merely a curtain-raiser for the jam on the Bay Bridge. But in fact more of the tunnel traffic turns to Berkeley, Oakland, and other East Bay destinations than continues on to San Francisco. Two separate jams are involved, and only a relatively small group suffers through both each day.

San Francisco does not come close to being the dominant employer in a single census tract in the East Bay. An East Bay workplace dominates in every instance; in no case does San Francisco account for more than approximately a quarter of the workers, and that in only four tracts out of four hundred. From such thin and holey cloth must be shaped any belief as to San Francisco's domination in the East Bay.

The East Bay Core is an industrial-wholesaling-transportation-institutional workplace rather than an administrative-fiscal one. For this reason the San Francisco newspapers overlook the East Bay's importance, although obviously to their ultimate discomfort, as these are the Bay Area's growth industries. The suburbanization of most types of shopping came in the decade of the 1950's. The suburbanization of commercial recreation and the more institutional offices should follow in the 'sixties. Already the outer parts of Marin and San Mateo counties

[44] See James E. Vance, Jr., "Labor-shed, Employment Field, and Dynamic Analysis in Urban Geography," *Economic Geography* 36:189–220, July, 1960.

have become the site of restaurants, as has the "hot region" of central Contra Costa County. The core cities of the East Bay—Oakland and Berkeley—have demonstrated a considerable interest in the activities that San Francisco formerly monopolized. Art shows and galleries, specialty shops, ethnic and other specialized restaurants, jazz and art theaters, and other core city functions are now well developed in the East Bay. For example, Berkeley ranks with San Francisco in showings of foreign movies.

The Bay Area will be a better place in which to live when its composition of parts is fully understood and accepted. Such a realization does not reduce San Francisco; rather it records "the City's" place accurately. And for the East Bay core it should make possible the creation of certain urban functions that have been denied the area through confusion. Most notable has been the absence of even basic jet air service to the East Bay. The East Bay itself must shoulder some of the blame, as there is a certain local group whose self-esteem in distant areas requires return tickets reading San Francisco rather than Oakland.

In the long run, however, any supplement to the air service in the Bay Area should logically take place in Oakland. Disregarding convenience, such a build-up would remove a considerable group of cars from the Bay Bridge at its most crowded time, as air schedules tend to be heaviest during the morning and evening rush hours. The reduction in bridge congestion that would come through the use of the newly built Oakland airport would be far greater, in relation to cost, than any possible reduction than can be hoped for from rapid transit.

Typical of the misconceptions that plague the Bay Area population through a failure to comprehend the urban structure is the view that it was foolish and wasteful for Oakland to build a jet airport. If New York or Los Angeles may serve as an example of a multi-centered metropolis, such as we have found the Bay Area to be, the existence of at least two major airports is both justified and desirable. New York could never care for its air travel without three major and several minor airports. Los Angeles, which shares with the Bay Area a multi-realmed settlement pattern, has three airports with scheduled service and uses all three. The tendency of the Bay Area to be different in economy on the two sides of the Bay, and the considerable physical and transportation barrier that the Bay interposes, indicate that a second airport has some justification. It is apparent that Oakland men analyzed the structure of the Bay Area more accurately than those who deride their decision to build a modern airport.

The main concern now is with the economics of air transport, not with the "right" of Oakland to have a jet airport. There are at present

definite economies of operation to be secured to the airline companies if they can concentrate Bay Area service in the San Francisco Airport. But the public also has rights in such a matter, and can ask of an airline not only the most profitable service pattern, but the most *desirable* profitable service. The quality of service available at the Oakland airport, the scheduling, the convenience, and the rate structure are all such that no fair test has yet been made of the Oakland facility's jet-age potential.[45] And that potential can be evaluated properly only when Oakland's air service is approximately comparable to San Francisco's in most respects. To date it falls far short of comparability, despite some significant improvements in recent months.

The Urban Frontier

The realms of the Bay Area include several "marches." In the Santa Clara Valley the pacification of the border-lands has been accomplished, in the main. Some may question the virtues of this act, but none can deny its reality. Starting from an agricultural base laid as long ago as the Gold Rush, the valley was urbanized for the most part after the Second World War. And that urbanization has shown the validity of the concept of transportation as the shaping force in cities. If San Francisco is the pedestrian city of the mid-nineteenth century, and Oakland the trolley city, San Jose is the automobile city. Fashion dictates a grimace at this point, but objectivity would be far less displeased. There are unlovely things in the Santa Clara Valley, but they are not in the least inferior to those created in railroad-shaped Manchester or Düsseldorf, or streetcar Chicago. The Santa Clara Valley has suffered political chaos for which it—along with the state government—should be stigmatized. But in the creation of an arterial street pattern that is sensible and in proportion, in the building of specialty shopping centers as well as workaday ones, and in the shaping of a number of quite real neighborhoods, the Santa Clara Valley is worth careful study. This area is also the place where the most extensive advance of the Bay Area's urban frontier has occurred.

The "frontier-at-the-center" is much more evident in San Francisco than in Oakland or other parts of the core. To understand this situation we must bring urban dynamics into sharper focus. Decay and disintegration, conditions that have called formal redevelopment into being, are the result of the interruption of normal urban processes. Two of the redevelopment proposals for San Francisco—the Golden Gateway to-

[45] In the spring of 1964, for example, two United Airlines flights were scheduled to leave Oakland and San Francisco at the same time, 8:35 a.m., and to reach Vancouver two hours apart—the San Francisco flight being favored. It is not surprising that the Oakland flight has since been dropped.

ward the docks from the financial district, and the far western edge of the central business district that is the Western Addition redevelopment area—are characterized by a collapse of normal functional development.

In the case of the Golden Gateway the predictable course would have been a slow change from its original wholesaling function to urban office use. Wholesaling is no longer very efficiently carried on there, and the docks have been reduced in importance by increased freighter berthing in Oakland, Stockton, and probably Sacramento. Yet the demand for office space has not been strong enough to cause this area to "turn," as has Park Avenue in New York. The alternative has been subsidized change through redevelopment. In the Western Addition the normal cycle would have brought in either apartment buildings or open low-height buildings for retail trade. San Francisco is a city of apartment dwellings for the comfortable—for the truly rich or those conditionally so, through spinsterhood and bachelorhood— or for the tenement-living poor. The comfortable can cluster where there is a view, while the tenement dwellers have already made the Western Addition unacceptable to the better-off San Franciscans.

Redevelopment has been instituted to try to "upgrade" this area, which means the further growth of areas for the housing of the comfortable. This pricing-out effort may have been relatively successful for San Francisco even before the Western Addition. The journey-to-work data from the 1960 census shows that a considerable part of the employment of Negroes from the belt of housing between West Oakland and Richmond is in San Francisco. This cross-bay movement of what must be basically industrial and manual workers is not matched by a similar journey-to-work in San Francisco from white working class residence areas in the East Bay.

A second cause of urban decay is a localization of the housing function. Residential areas characterized by a restriction of housing to people employed in a narrow local labor market have shown a tendency to decay. Vallejo is a case in point, although Pittsburg or the old Western Addition might also serve. With a high degree of localization of employment, a housing area falls prey to cyclical changes in the local economy and to a "built-in" aging of the population. Thus, a housing area used by workers employed in a number of different locales is less given to cyclical extremes. Such an area does not become passé merely due to a localized industrial shift or collapse. But this type of urban decay has afflicted both the centrally located Western Addition and West Oakland, as well as the older industrial satellites such as Vallejo and Pittsburg. These areas typify the second of the two urban frontiers.

* * *

The Bay Area presents an unusual opportunity to look at a major metropolis throughout its life-cycle, and to evaluate the forces that influence its over-all stature, the use that is made of its components, and the evolution of the present urban landscape. Such an opportunity is worthwhile for more than intellectual interest alone. It is critical if we try to explain the way in which a city grows and to formulate generalizations that might be called *urban dynamics*. This is not the place for a full discussion of dynamics, but it is clear that only a study of dynamics can allow us to plan for the future intelligently.

The Franklin K. Lane monographs on the San Francisco Bay Area set out to assess the present and to discuss the future. This look at the physique of the Bay Area urban realms falls in with that purpose more in the assessment of the present than in the design for the future. Such a design must of necessity comprise two elements: a full knowledge of local urban dynamics and a full understanding of the objectives of the local population in relation to that future. Not the least important words in this statement are those two adjectives "local." Although this is no call for parochialism, it must be emphasized that the main reason for studying the Bay Area in detail must be to adjust planning practice originated elsewhere to conditions that exist in this region.

The conclusions of this study are many, but the following are singled out for emphasis. It should be observed by now that the Bay Area, like all urban regions, is highly dynamic. Romantic attachments to the region as it was in the past will not make the organism any more viable today. An understanding of urban dynamics will, however, allow us to introduce certain goals for the future with some reasonable hope that they may be achieved. The most persistent feature of the physical history of the Bay Area is the great impact of transportation on the design and functioning of those parts of the region that came into existence during eras dominated by particular transportation media.

These sections created under each of several successive transport technologies have adjusted to subsequent forms, and the successful adjustment has produced a metropolis composed of several *urban realms*. These major functioning parts of the urban region have tended to become internally coherent with time, greatly reducing the external dependencies that may have existed in their formative years. Thus the Bay Area is no longer "centered" on San Francisco, which serves merely as one of a number of foci, although it is the one that is most "newsworthy" and most prized by the "power-elite."

The City in Concert: Sympolis

In this creation of a metropolis-of-realms we witness the birth of a new urban form. Patrick Geddes in 1915 gave us the term "conurbation" in describing the growing together of previously discrete towns to form a metropolis.[46] Such a metropolis, however, implies a parental relationship, the central city representing one "generation" and the outlying areas its offspring. Both in the Bay Area and in urban areas in general the concept of the metropolis is no longer adequate. Parentage of peripheral sections is often obscure, and in many instances the parts of the continuous urban area stand as peers of equal hierarchical position.

Today the emergent urban form is that of increasing areal integrity in daily activities, so that the structure is one of functional parochialism within a broad regional episcopate. The ties between the two levels of activity are strong and formal, as in ecclesiastical organization, but one should not confuse a part with the whole, as might be the case if we call the total urban region a metropolis. The deficiencies of the term conurbation have already been cited. In its place we seek to convey the idea that each realm in the urban region stands as a functional equal to all others, and that it is the cooperative labors of the lot that give us our urban economy. Also, it is the shared attitudes of all segments of the urban population that comprise the real urban culture. Such an idea of equality and concert suggest that today we begin to see the *sympolis*[47] in its youth.

[46] Patrick Geddes, *Cities in Evolution,* London: Williams and Norgate, 1915.

[47] This term, the sound suggestion of Mr. R. H. F. Dalton of the University of Birmingham, England, may serve to emphasize the two attributes noted in the last sentence. Thus it may overcome the implied dependence of the outer parts of the urban region on the centrally located "core," a connotation that cannot be winnowed from the term metropolis.

VI

CATHERINE BAUER WURSTER

THE FUTURE OF CITIES . . .

Housing and the Future of Cities in the San Francisco Bay Area

INSTITUTE OF GOVERNMENTAL STUDIES
University of California • Berkeley, California
DWIGHT WALDO, Director

Housing and the Future of Cities in the San Francisco Bay Area

BY
CATHERINE BAUER WURSTER
Department of City and Regional Planning

1963

Foreword

With the publication of this monograph by Catherine Bauer Wurster, the Institute of Governmental Studies is pleased to initiate its series of Franklin K. Lane papers on the problems and future of the San Francisco Bay Area. In all, some fifteen papers are projected for issuance during the next several months. These will deal with such varied topics as housing and city growth, intergroup relations, population trends, economic trends, governmental finance, transportation problems, public support of cultural activities, welfare and dependency problems, public education, regional planning needs, the governmental structure of the area, and others.

Our intent in commissioning the Lane papers was to focus the varied competencies of the University on local and regional problems here in the San Francisco Bay Area, and to do it within the scope of a single series of monographs. These papers are not being presented with any thought that the University should "tell the Bay Area what it ought to be doing." Despite its distinguished reputation the University is hardly that omniscient. Also, the existence of important areas of disagreement *among* the contributors rules out such a one-sided function of "instruction." Rather, these papers represent a new opportunity for the University community to participate in the debate on Bay Area problems. Each author speaks for himself in expressing viewpoints and opinions, raising questions, posing issues, presenting facts, and speculating on what the future holds. Thus, the papers will, we hope, contribute significantly to the continuing discussion of Bay Area problems and the search for solutions.

The series takes its name from Franklin Knight Lane (1864–1921), a distinguished Californian who was successively New York correspondent for the *San Francisco Chronicle,* City and County Attorney of San Francisco, member and later Chairman of the U. S. Interstate Commerce Commission, and Secretary of the Interior in the Cabinet of President Woodrow Wilson.

Shortly after Franklin K. Lane's death, a group of friends arranged for the establishment of a fund to be held and invested by Herbert Hoover, Adolph C. Miller and Franklin D. Roosevelt, for the benefit of Mr. Lane's widow during her lifetime, and thereafter for some purpose to perpetuate his memory. In 1939, the three trustees acted to establish the Franklin K. Lane Memorial Foundation at the University of California, Berkeley. The general purposes of the foundation are to promote the "better understanding of the nature and working of the

American system of democratic government, particularly in its political, economic and social aspects," and the "study and development of the most suitable methods for its improvement in the light of experience."

In 1958, when Chancellor Clark Kerr, now President of the University, moved to allocate income from the Lane fund to the Bureau of Public Administration (now Institute of Governmental Studies), it was agreed that the initial effort should concentrate on studies of Bay Area problems. The current series of monographs is presented in partial fulfillment of this commitment.

The papers will be issued individually at short intervals during the next few months, as they become available. When all have been published separately, the papers will be reissued in one or more bound volumes for the convenience of readers wishing a complete set.

I express my gratitude to the many contributors to the Lane series, most but not all of whom are colleagues here on the Berkeley campus. Finally, I would like to thank Stanley Scott, Assistant Director, who originated and administered the project, and is serving as editor of the monographs.

DWIGHT WALDO
Director

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Introduction

Information about the people of the Bay Area, their physical environment and how they use it, is increasingly available from the 1960 Census and other sources. Some of this factual data will be used to describe the main features of the housing stock, to indicate how and where different kinds of people live, to document certain trends and problems, and to suggest their future implications.

Judgment about living conditions and desirable future policies cannot, however, be wholly objective. At best the data are crude and oversimplified, with large unquantifiable gaps. And in any case the material selected, the points emphasized and the conclusions drawn, are unavoidably influenced by the author's particular viewpoint and the values he considers important. No one opens a Census volume on his own state or community with a blank or impartial mind. He starts with some hypothesis, derived from personal experience and professional interests. Then he looks for the figures which will support (preferably) or qualify (reluctantly) the judgments he has already formed. In a way, therefore, the most scientific approach is to begin by frankly exposing one's biases. If the reader disagrees, he is then free to dig up different evidence supporting his own assumptions.

I start out with a firm conviction that the Bay Area has certain very special qualities as a place to live in, qualities which should be preserved and enhanced in the course of future growth. Other things being equal, I'd rather live here than anywhere else. This feeling is based on rather wide knowledge of other metropolitan communities around the world, but it is so personal that even though I am a professional urbanist it is very difficult to say exactly what these qualities are. Let me try to pin them down, however inadequately.

In the first place I lived two thirds of my life on the East Coast, and the environment and culture of the Bay Area have always seemed to represent a kind of cross between West and East, not merely a dull compromise but with many of the strongest and most attractive features of both. This is more or less true of temperature, humidity, vegetation and geography, which together give us a unique and stimulating mixture of natural amenities. There is rich farmland, often producing unique specialty crops, wild areas for every kind of recreational taste, variegated views for passive enjoyment.

In addition, this is the oldest Western settlement and it has had a lively cosmopolitan history which is part of the folklore of the world. We have therefore inherited a degree of urbanity quite unusual in the

West, and this influences our environment both directly and indirectly. San Francisco is a great city in the traditional European sense, a major center for business, culture and entertainment whose qualities have always reflected the stimulation inherent in a highly variegated population living close together. Berkeley and Oakland also have some of this quality to a greater degree than most secondary metropolitan centers. And although many of the older outlying subcenters have been swallowed up in suburbia, there are still some communities on the fringe which have their own identity and traditional character as independent towns.

But these are also Western cities, the historic end of the line. All kinds of people have come from everywhere, and still keep coming, rich and poor, all colors, nationalities, religions and cultural backgrounds. There has been plenty of conflict and prejudice along the way, but there is also tolerance, fluidity and a certain pride in cultural differences. San Francisco and Berkeley are the Boston and Cambridge of the West, but the class lines are much less rigid, both in social habits and in living conditions. There is opulence and poverty, but change and mobility are also taken for granted. And the general level of taste is relatively free and sophisticated in food, entertainment and the arts, perhaps particularly in the Bay Area's special contribution to modern architecture.

Living here has meant stimulation and opportunity: a wide choice of life-styles in homes, work and leisure-time activities, a wide range of casual and selective contacts, within a short trip, often within the same small area. But this is not just due to variety, it is also the direct result of *scale*. Visitors often remark that San Francisco has many of the worldly attractions of New York but it's easier to enjoy them because they are relatively close together. The same thing is true of beaches and mountains, universities, wineries and race tracks. The moderate scale, and the degree of diversity and balance even within sub-sectors of the region is what makes the choices real and meaningful and gives character to the whole area.

But these are the very qualities we are most likely to lose if post-war trends continue for the next few decades. Let me inject a single figure into this nonstatistical introduction. Between 1960 and around 1980 we shall probably need to construct well over a million new homes somewhere in the Bay Area. This will represent an increase of almost one hundred percent over the number of dwellings in 1960. Many of the latter will disappear during the next few decades, consequently over half the population in 1980 will be living in homes and neighborhoods which do not now exist. Where and how they live—the design,

price and location of these new homes—will be the major determinant of future living conditions and life-style choices for everyone in the Bay Area.

The housing supply, with its market limitations, has two different kinds of effect. One is direct and obvious: the type of shelter available to a given family at a given price in a given place. But it also creates the residential pattern, which affects the basic structure and quality of metropolitan life in many different ways. For one thing, housing is the great aggressive land-eater, which can readily destroy all the convenient open space and natural amenity that once enriched a whole region. It largely determines both the visual and structural character of communities. And homes are not only shelter; they also are the base points in an increasingly complex network of interrelationships and communications. Where people can find suitable homes determines the range of job choice, the journey to work, and also to play, hence the transportation problem. It affects race and class relations, the local tax base and the structure of local government, and to a very great extent the functional, economic and political organization of the entire metropolitan community.

The Bay Area has had certain unique qualities as a place to live in: a rich diversity of natural and man-made environments, of identifiable communities, of people and their activities, knit together in a kind of ecological balance at a scale which made the variety of choices and contacts an integral part of everyday life. But these qualities have been weakened in the wave of postwar expansion. They will be largely lost if present trends continue for another decade or two. And although many factors contribute, the most powerful force is residential development: the wasteful shapeless sprawl; the standardized tract; the one-class enclave whether at low or high density; the rising disparity between home and job locations; the economic and racial limitations in the housing market which are gradually ghettoizing the older cities; the resulting chaos and conflict in local government.

Housing must be viewed in a broader context, as the recent report of the Governor's Advisory Commission on Housing Problems makes clear. Many of the commission's judgments and recommendations are reflected in the present study, whether or not the members would agree with these interpretations.

The Present Situation: Progress, Problems, Policies[1]

Although the Census indicators are very crude, it seems evident that the over-all quality of the housing supply has improved considerably throughout the nation in recent decades, and that physical living conditions are generally better here than in most big Eastern cities. Despite rising incomes, however, and the larger share of household budgets devoted to shelter, the effective market for new housing is much more strictly limited to upper-income families than it was in 1950. Also, the proportion of substandard dwellings appears to be larger here than in the Los Angeles area.

Certain groups suffer serious disadvantages in the residential market, due not only to low incomes but also to special problems which are by no means on their way to solution. These groups include ethnic minorities subject to widespread discrimination in housing, recent immigrants of all ethnic groups who have educational disadvantages for urban life and for present-day job opportunities, the aged who cannot find housing suited to their special needs, and households forcibly displaced by clearance operations of various kinds. These groups tend to overlap, which means that many people suffer from several kinds of disability at the same time. Their proportion of the total population is increasing, and current housing and renewal policies are not meeting their needs.

Meanwhile the limitations of the housing market and locational choice are inducing basic trends toward class, race and age segregation which could have serious future implications for the social, functional and civic organization of the metropolitan region and its communities.

The 1960 Stock of Housing: Physical Characteristics

The traditional nine-county Bay Area is employed as the basis of the discussion in this section and, where feasible, elsewhere in the paper. In terms of Census tabulations, however, there are two standard metro-

[1] Most of the factual evidence in this article has been borrowed from studies recently completed for the Governor's Advisory Commission on Housing Problems, by Donald Foley, Sherman Maisel, Wallace Smith and Catherine Wurster. Although most of the data comes from the Census Bureau and other public sources, special information and tabulations would not otherwise have been available for the present paper. Some of this material is included in the commission's report, *Housing in California,* January 1963, and the studies will be published in full this spring. Acknowledgment is also due the Ford Foundation for data from continuing work under a grant to study "Renewal in the Western States."

politan statistical areas in the region—San Francisco–Oakland with six counties, and San Jose with Santa Clara County—plus two independent counties, Napa and Sonoma. Fewer data are available for nonmetropolitan counties than for SMSA's, and there is more information for the San Francisco–Oakland SMSA than for the San Jose area. "Urbanized areas" within SMSA's are also delineated by the Census: these exclude major rural areas and outlying independent towns. In later sections it is therefore necessary to shift the geographic frame of reference from time to time. Total dwellings in 1960 for these various divisions were as follows:

Area		*Housing units 1960*
San Francisco–Oakland SMSA		978,400
Urbanized area	861,400	
San Jose SMSA		199,900
Urbanized area	187,000	
Napa County		21,200
Sonoma County		59,800
Nine-county Bay region		1,259,300

The figures and percentages shown in Table 1 point up certain aspects of the over-all housing picture in the nine Bay Area counties, including some basic differences between the two central cities and the balance of the area where almost two thirds of the homes and households are now located.

Of the 423,000 dwellings built between 1950 and 1960, 90 percent were in outlying areas and only 10 percent in the two cities, where 79 percent of the homes were over 30 years old.

Detached 1-family homes account for 61 percent of the total supply, but only 29 percent in the two major cities, where 58 percent of the dwellings are multi-family. More than half the 1-family attached (or row-type) homes are in San Francisco. While trailers occupied as normal residence were negligible in the two central cities (116 in all) there were 11,000 of them in the rest of the area.

The rough indicators of high and low quality show an almost equal volume of 2-bathroom homes on the one hand, and of substandard dwellings on the other, about an eighth of the total supply in each case. The number with extra bathrooms was disproportionately high in outlying areas, however, while the central cities had much more than their share of the lower-grade units.

In most of these characteristics—growth rates, dwelling types, age, and quality—the Bay Area falls somewhere between Los Angeles and the large Eastern centers. Even for the six-county SMSA, however, the

TABLE 1

CHARACTERISTICS OF THE 1960 HOUSING STOCK IN THE BAY AREA, ITS TWO CENTRAL CITIES, AND THE REMAINDER OF THE NINE COUNTIES

	Dwellings 1960			Percent of total in category			Percent of total in area		
	9 counties	San Francisco and Oakland	Balance of 9 counties	9 counties	2 cities	Balance	9 counties	2 cities	Balance
Total dwellings	1,259,000	452,000	807,000	100	36	64	100	100	100
Types of structures									
1-family detached	765,000	130,000	635,000	100	17	83	61	29	79
1-family attached	94,000	60,000	34,000	100	64	36	7	13	4
2-or-more family	389,000	262,000	127,000	100	67	33	31	58	16
Trailer	11,000	(226)	11,000	100	..	100	1	..	1
Age									
Built 1950–60	423,000	44,000	379,000	100	10	90	34	10	47
Built before 1930	611,000	355,000	256,000	100	58	42	49	79	32
Quality									
2 or more bathrooms	165,000	28,000	137,000	100	17	83	13	6	17
Substandard[a]	154,000	76,000	78,000	100	49	51	12	17	10

SOURCE: U. S. Bureau of the Census, *1960 Census of Housing, Final Report HC(1)-6: State and Small Areas: California.*

[a] Includes the new category, "deteriorating," as well as homes which are "dilapidated" or lacking in plumbing facilities

proportion of homes outside the central cities is considerably higher than for most metropolitan areas throughout the country.

Basic Changes in the Housing Supply: 1950 to 1960

The critical postwar housing shortage was still severe in 1950, with available vacancies at 2.3 percent in the San Francisco–Oakland SMSA, and similar rates in the three other counties. In San Francisco the rate was only 1.5 percent. During the decade the net increase in dwellings ran ahead of household growth, and by 1960 the net vacancy rate was almost 4 percent for the nine counties and around 4.5 percent in San Francisco (although unevenly distributed by size and price).

In December 1959, four months ahead of the regular housing census, the Census Bureau ran a sample survey of the "components of inventory change" in the major metropolitan areas, including the San Francisco–Oakland SMSA. We therefore now have some data on various factors that affect changes in the housing supply. Table 2 gives the basic Inventory figures for the six-county area, with tentative estimates for the other three counties and the region as a whole. The units added by construction and other means, minus the units lost by demolition, fire, flood, etc., equal the net increase in dwellings for the area. Since Inventory and 1960 Census data are not wholly comparable, rough adjustments were necessary in the 1960 figures to allow for net increase and new construction in the three outside counties.

The rate of new construction was below average in the six-county SMSA, very high in Santa Clara and just above average in Napa and Sonoma where the suburban push has not yet begun in earnest. It was assumed that the rate of increase by means other than new construction might be approximately the same throughout the region, with relatively more conversions in older areas, more trailer homes elsewhere. The high estimate for units "lost" in Santa Clara County which results from these rough but defensible hypotheses is worth pondering. Freeways and natural disasters take their toll everywhere, but not at this rate. In the six-county area a quarter to a third of the units lost were probably temporary war-workers' homes demolished or removed during the decade, and therefore abnormal, while renewal programs would have accounted for a very much smaller fraction. But neither of these factors would have been significant in Santa Clara County, where estimates produced a similar ratio. Some evidence suggests, however, that quite a large number of scattered older homes, ranging in quality from shacks to adequate but simple dwellings, tend to disappear in a wave of large-scale suburban development with rising land values and also stricter code enforcement. Since new suburban housing is increasingly

TABLE 2

NET CHANGES IN THE BAY AREA HOUSING STOCK, 1950 THROUGH 1959

Area	Total dwellings 1950	Net increase 1950–1959	Units added 1950–1959		Units lost 1950–1959[c]
			New construction	Other means[b]	
			plus	*plus*	*minus*
San Francisco-Oakland SMSA (6 counties)					
Number	741,700	189,600	251,700	23,500	85,600
Percent of 1950 stock	100	25.6	33.9	3.2	11.5
San Jose SMSA[a] (Santa Clara Co.)					
Number (estimated)	91,700	104,200	112,100	2,800	10,700
Percent of 1950 stock	100	113.6	122.2	3.0	11.7
Napa and Sonoma Counties[a]					
Number (estimated)	53,700	25,700	26,800	1,600	2,700
Percent of 1950 stock	100	47.9	49.9	3.0	5.0
Nine-county area estimated total	887,100	319,500	390,600	27,900	99,000
Percent of 1950 stock	100	36.0	44.0	3.1	11.2

SOURCE: U. S. Bureau of the Census, *United States Census of Housing, 1960, Components of Inventory Change, Final Report HC(4) Part 1A-17: 1950-1959 Components: San Francisco-Oakland.*

[a] Since no survey of inventory change was made in these counties, the components had to be estimated. Inventory and Census data for total dwellings and new construction differ for various reasons, and the 1960 Census figures for the three counties were therefore roughly adjusted. It was assumed that the proportion of units added by other means than new construction might be around 3 percent. The total units added minus the net increase gives an estimate of units lost.

[b] Converted from larger unit or nonresidential use, or moved to site.

[c] By demolition, fire, flood, merger, conversion to nonresidential use, etc.

expensive, this process tends to reduce the supply of cheap homes in outlying areas to a marked degree.

From this general view of the housing stock and what has been happening to it, we move to a closer scrutiny of two key sectors—recently built homes and substandard dwellings—both of which are directly affected by policies of various kinds. If we can learn something about the people who live in these two types of housing, this will help to clarify the nature and limitations of the current housing market and the effects of policy.

New Housing: The Narrowing Market

About 70 percent of the homes constructed in the region between 1950 and 1960 are owner-occupied, but the proportion of new rental housing has risen considerably in recent years. The size of both houses and lots in suburban development has been increasing, while the proportion of apartments in high-density elevator structures has also gone up. Prices have risen more rapidly than incomes in both categories, however, and racial discrimination has further limited the effective market for new housing.

Despite the towers which are changing San Francisco's skyline, the dominant trend is toward far-flung low-density development in scattered tracts of varying size which are usually quite standardized in type and price of accommodation. Although the Census definition of an

TABLE 3

URBANIZED AREAS IN 1960 AND 1950, SAN FRANCISCO-OAKLAND AND SAN JOSE

	San Francisco-Oakland SMSA (6 counties)	San Jose SMSA (Santa Clara County)
Population of urbanized area:		
1950	2,022,000	176,000
1960	2,431,000	603,000
Percent increase	20	243
Extent of urbanized area:		
1950	287 sq. mi.	61 sq. mi.
1960	572 sq. mi.	223 sq. mi.
Percent increase	99	266
Population per square mile of urbanized area:		
1950	7,038	2,912
1960	4,253	2,702
Percent decrease	40	7

SOURCE: U. S. Bureau of the Census, *1960 Census of Population, v. 1, part A, Number of Inhabitants.*

"urbanized area" is necessarily rough, Table 3 shows the gross picture with respect to density trends. In the San Francisco–Oakland SMSA, the urbanized area almost doubled while the population increased by only 20 percent, with the result that the population per square mile went down from 7,000 to around 4,200. In the San Jose urbanized area, on the other hand, there were only 2,900 people per square mile in 1950. But the enormous wave of urban development and new "city" formation which took place in the 1950's only reduced the over-all den-

TABLE 4

INCOMES OF HOME-PURCHASERS AND ALL FAMILIES 1960, SAN FRANCISCO-OAKLAND SMSA

Income groups	Purchasers of new FHA houses, 1960		All families 1960 (except "unrelated individuals")	
	Cumulative percent	Percent	Cumulative percent	Percent
Less than $5,000	.2	.2	26.1	26.1
$5–6,000	2.2	2.0	37.0	10.9
$6–7,000	13.4	11.2	49.0	12.0
$7–8,000	30.3	16.9	59.7	10.7
$8–9,000	46.0	15.7	68.5	8.8
$9–10,000	62.2	16.2	75.6	7.1
$10–15,000	94.1	31.9	92.5	16.9
Over $15,000	100.0	5.9	100.0	7.5

SOURCES: U. S. Federal Housing Administration, *FHA Homes 1960: Data for States and Selected Areas on Characteristics of FHA Operations under Section 203* (1961); U.S. Bureau of the Census, *United States Census of Population: 1960, PC(1)-C, General Population Characteristics, no. 6, California.*

sity still further, to 2,700 people per square mile. While even in San Francisco and Oakland, despite the new high-rise development, the 1960 density of 11,000 per square mile was slightly less than the 1950 figure, since both cities lost population.

With all this expansion, along with rising incomes and purchasing power, the effective market for new housing has nevertheless contracted. The narrowness of the market for new FHA-insured single-family homes in 1960 is indicated in Table 4 (and it is probably still more limited now), although FHA and Census income data are only roughly comparable.

For the lower third income group almost no FHA-insured homes were provided, and only about 14 percent of the new FHA houses reached the lower half. Most were bought by the top 30 percent. (However, FHA-insured homes do not provide a cross-section of the market. Both the cheapest and the most expensive houses tend to be financed from "conventional" sources, but the former would usually be below officially accepted minimal standards in certain respects.)

No similar table is possible for 1950, but there are some general indicators in Table 5 which suggest the trend. Between 1950 and 1960 the median income of all Bay Area families increased by around 80 percent and of all home-owners a bit less, but the median "effective" income of new FHA house buyers was about doubled. Also, while the median value of all owned homes increased by 42 percent the median value of new FHA homes rose by 92 percent. A detailed analysis of the 1950 situation in the Bay Area can be found in Sherman Maisel's book,

TABLE 5

HOUSING MARKET TRENDS, SAN FRANCISCO-OAKLAND SMSA

	1960	1950	Percent increase 1950–60
Median annual income:			
Purchasers of new FHA homes:			
Estimated effective income....	$8,376	ca. $4,200	99
Actual current income.....	9,247	....	..
All families in SMSA (except unrelated individuals).....	7,092	3,935	80
All owner-occupants, SMSA.....	7,500	ca. 4,200	79
Median property value:			
New FHA houses.....	17,000	ca. 8,900	92
All home-owners.....	16,300	ca. 11,500	42

SOURCES: U. S. Federal Housing Administration, *FHA Homes 1960: Data for States and Selected Areas on Characteristics of FHA Operations under Section 203* (1961); *FHA Homes in Standard Metropolitan Areas 1950: Pacific Division* (1952). U. S. Bureau of the Census, *1950 Census of Population, v. 2, Characteristics of the Population, part 5, California; 1950 Census of Housing, v. 1, General Characteristics; 1960 Census of Population, PC(1)-C, General Social and Economic Characteristics, no. 6, California; 1960 Census of Housing, Final Report HC(1)-6, State and Small Areas: California.*

Housebuilding in Transition (University of California Press, 1953). He estimated that practically all regularly employed workers could afford a new house at that time. In any case, the evidence indicates that the market for new homes, FHA-insured as well as conventionally financed, extended well below the median income level into the lower third.

Table 6 compares certain average characteristics of new FHA-insured houses for 1960 and 1950. The average house was more than 20 percent larger and its value was 88 percent higher, but the value of the site had increased by almost 150 percent. In his study for the commission, Professor Maisel stresses the steep rise in land costs as a major factor in higher house prices. The estimated effective income of the average purchaser went up 101 percent, and monthly mortgage payments increased by 106 percent, due in part to higher financial terms. This is particularly notable, since families with higher incomes normally spend a considerably smaller proportion of their budgets for housing. Professor Maisel shows that at all income levels there has

been a very substantial increase in housing expenditures since 1950, reversing the former downward trend despite the fact that transportation costs have also been rising for suburban families.

The high cost of new houses therefore has a double effect on the market. The proportion of families by income groups who buy new homes is quite a bit smaller than it was in 1950, and it would be a great deal more restricted if some people were not forced or induced to spend a larger share of their incomes for shelter than they would have formerly.

TABLE 6

AVERAGE CHARACTERISTICS OF NEW FHA HOMES (SEC. 203), 1950 AND 1960, SAN FRANCISCO-OAKLAND SMSA

FHA estimates	1960	1950	Increase 1950–60
Floor area, square feet	1,250	1,026	22%
Rooms	5.8	4.8	1 room
Property value	$17,536	$9,308	88%
Site value	$3,295	$1,339	146%
Monthly effective income of mortgagor	$731	$363	101%
Monthly mortgage payment except property taxes	$101	$49	106%

SOURCES: Same as Table 5.

The rental market is somewhat broader, but detailed market data is lacking. The Census Inventory records about 70,000 rental units built in the six-county SMSA from 1950 through 1959, and at the end of the period 53 percent rented for less than $100 a month. They were relatively small, predominantly 3–4 rooms or less, but apparently housed quite a large proportion of 3–4 person households. Some are subsidized public housing, but most of the privately owned cheaper units must be part of the recent wave of 2- and 3-story apartments in outlying areas. With a few distinguished exceptions they tend to be drab and ill-planned, but they do provide the only moderate priced new housing available. New apartments in central districts tend to be very expensive, as a survey of 4,500 "recent, non-luxury" units in San Francisco shows.[2] Households were small, with a median income of $8,250, and the residents paid a median rent of $135 in one-bedroom apartments, $168 for 2 bedrooms.

Price is by no means the only limiting factor in the market for new housing, which tends to exclude nonwhite families irrespective of in-

[2] "Rental Units and Households in Recent Multi-Family Construction, San Francisco County, California," Project Service Company, San Francisco, July 1962.

come. Over 10 percent of the households in the six-county area are nonwhite. However, nonwhite families occupied only three percent of the homes built in 1959 and early 1960, and it is highly probable that most of these were concentrated in a few small areas. Discrimination against Orientals seems to have declined somewhat here and there, but the number of Negroes in new suburban tracts is almost nil except in a few isolated and more or less segregated districts. Even in San Francisco, the survey of recently constructed apartments showed that there were no Negroes in structures which contained 97 percent of the units, and no Orientals in buildings with 78 percent.

As long as nonwhite households were predominantly in the lowest income group, price limitations alone kept them out of new housing. But with rapidly increasing numbers at all income levels and a rising proportion in the middle and upper groups, the restrictive efforts of prejudice become continually more pronounced.

Standardization is also a limiting factor in the housing market, particularly in an era when broadening needs, means and tastes are calling for a wider range of choice in housing design and location. In relatively expensive tailor-made houses, and in the work of a few sophisticated builders and redevelopment agencies, the Bay Area has achieved architectural fame and national leadership. But the vast mass of commercial building conforms to a few crude types, each monotonously repeated under any given set of conditions. Over-standardization is further promoted by zoning practice, and by bureaucratic rigidities in public and private lending agencies. Meanwhile household needs are more and more differentiated. Old people and many single workers now want to live alone. On the other hand, there are more large families than there used to be with higher standards of privacy. Moreover, differing requirements for convenience and leisure-time pursuits create a wide range of needs in terms of location and neighborhood environment.

Together all these limitations add up to the fact that higher incomes have not bought us a wider or richer choice in terms of our physical environment. Some of the implications for present and future policies will be considered later. At this point we must turn from the market for new housing to the polar problem of slums and blight.

Substandard Conditions and Disadvantaged Citizens

Census data provide a very crude index of housing quality, at best, and no indication of neighborhood conditions. Areas officially designated as "slum" or "blighted" always include a large proportion of dwellings which are standard by Census measures. Moreover, the definitions and

classifications have been different in each of the Housing Censuses—1940, 1950 and 1960—and there is therefore no over-all measure of quality change, however crude. The special sample survey of "Components of Inventory Change," made in December 1959, was intended to provide such an index for the major SMSA's, since it used 1950 definitions. But after an earnest effort to derive some judgments about trends in the San Francisco–Oakland area, by comparing Inventory

TABLE 7

STRUCTURAL CONDITION AND PLUMBING FACILITIES, BAY AREA HOUSING, 1960

	San Francisco-Oakland SMSA	San Jose SMSA	Napa and Sonoma Cos.	Total
All units	978,205	199,866	80,960	1,259,031
Sound	893,326	184,027	67,332	1,144,685
With all plumbing facilities.	856,467	181,401	65,584	1,103,452
Lacking only hot water	652	155	232	1,039
Lacking other plumbing	36,207	2,471	1,516	40,194
Deteriorating	67,311	11,093	10,236	88,640
With all plumbing facilities.	52,204	9,603	9,086	70,893
Lacking only hot water	275	110	123	508
Lacking other plumbing	14,832	1,380	1,027	17,239
Dilapidated	17,568	4,746	3,392	25,706
Total substandard units (All units minus "sound with all plumbing facilities")	121,738	18,465	15,376	155,579

SOURCE: U. S. Bureau of the Census, *1960 Census of Housing, Final Report HC(1)-6: State and Small Areas: California.*

data with 1950 and 1960 Census figures, my only positive conclusion is that *all* the Census data on structural quality are probably quite weak.

As a rough indication of housing quality, however, Table 1 showed that the 1960 Census found 154,000 substandard dwellings in the nine-county region, with almost half of them in San Francisco and Oakland which had only 36 percent of the total homes. The proportion substandard in the central cities was 17 percent, while in the great suburban belt with almost two thirds of the homes in the region less than 10 percent were below par, and these were mainly in a few older subcenters or on the outer rural fringe where there are still some shack-type slums. Table 7 shows the over-all breakdown by type of deficiency.

Particularly in the West, blighted areas and bad living conditions need to be viewed in more dynamic terms than has been habitual in the East. The problem of improvement is not just a matter of replacing

a fixed amount of obsolete real property but of improving the development process itself to obviate the continual creation of asocial conditions. A little history may clarify this point.

If "slum" implies a Dickens or Daumier image of cities dominated by congested, highly insanitary tenements, the Bay Area has little to worry about. Outside of a few small enclaves such as Chinatown, the crowded built-in slum which large-scale commercial builders provided for 19th century immigrants to most Eastern centers has never developed in the West. This was not because San Francisco or Oakland was more enlightened, but because they were relatively small and fluid cities which still had cheap land on the outskirts. In the frontier tradition a great many poor people built their own makeshift homes, with minimal services and controls. Simultaneously, within our mobile, rapidly growing communities other newcomers crowded into middle- and upper-class dwellings whose former occupants had already moved outward.

These two different methods of providing the necessary supply of low-priced homes for a rapidly growing region produce the two different types of residential blight which confront us today: (1) the hand-me-down central district with large homes which have been converted into small flats and rooming houses; and (2) the cheap tract which was originally built on a more or less self-help basis in an uncontrolled, badly serviced rural or fringe area. The Western Addition and West Oakland are in the first category, which is probably expanding in most of the older cities despite renewal efforts. Surviving examples of the second type are North Richmond, Russell City, and Alviso.

Cheap fringe settlements, including motel and trailer slums as well as shacktowns and modest but decent tracts, were stimulated during the depression, and sometimes they improved themselves considerably with rising incomes despite the fact that their tax-base was usually too low to support good services. But they have been rapidly disappearing since the end of World War II, due to the enforcement of state and county building codes or because they were bought out and swallowed up by the advancing wave of higher-priced suburban development. Redevelopment is a new factor, and even Russell City—a famous shacktown which has made itself into a decent community of self-respecting home-owners of minority race—will probably soon be forcibly replaced by industry. Thousands of units of temporary war workers' housing have also been removed, for the most part in outlying areas such as Richmond and Vallejo. The supply of cheap housing in suburbia has therefore been greatly reduced, and the people from Russell City will probably have to move into Oakland.

But, low-income and minority in-migration continues on a higher scale than ever, and increasingly these families have no alternative but the older central districts. They cannot provide their own homes because land prices, discrimination, building codes and zoning are all prohibitive. When the central blighted districts are torn down, whether by private or public initiative, similar conditions therefore tend to develop in adjacent neighborhoods. Blight is not a static situation.

Deficient dwellings are likely to be clustered in areas where neighborhood conditions and public services are also below standard, affecting a great many homes which are technically "standard." Such areas are occupied to an increasing degree by people with special problems whose inadequate housing reflects not only low incomes but other disadvantages as well. The most obvious is race discrimination, which keeps a great many Negroes from moving into better neighborhoods even when they can afford the prices. About one third of the substandard homes in San Francisco, Oakland and Berkeley are occupied by nonwhites. But discrimination is not only related to race and color. The Census shows that people with Spanish surnames—"Mexicans"—are almost as ghettoized throughout the state as nonwhites. With their rural traditions, however, they are more often found in the outlying shacktown type of environment. In Santa Clara County they live in 28 percent of the substandard homes.

In a study for the Governor's Commission, Wallace F. Smith used current Census data to analyze certain differentials which must largely result from discrimination *per se*. Combining the two major California SMSA's he compared the housing conditions of three ethnic groups at the same income levels. Both nonwhite and "Mexican" households were markedly worse off than majority-white families in the same economic group, both in the high proportion living in unsound housing and the low proportion occupying recently built dwellings or owned homes. They also occupied a disproportionate share of the crowded and doubled-up dwellings.

The basic weakness is not in the physical structures which these families are forced to occupy, nor is it solely in their low incomes. It is a fundamental weakness in the whole process of in-migration and assimilation. Better housing alone will not solve their problems. Better education, better economic opportunities, and a greater degree of social integration are at least equally important. The lack of choice in both housing and social contacts is documented by Professor Smith in a table showing the heavy concentration of minority households, not only in older cities but also in a few census tracts within those cities.

Another large group with special disadvantages in the housing mar-

ket is the aged, who increasingly live alone or in couples and very often in highly inadequate conditions. This group is still predominantly white, and it accounts for the fact that in one of Smith's categories—households paying 35 percent or more of their income for shelter—majority-whites had the highest ratio. Single workers of all ages have similar problems, and over half the substandard units in San Francisco, Oakland and Berkeley are occupied by 1-person households, with a much smaller proportion in outlying areas. In an over-standardized housing market, the needs of small households—including the special requirements of the elderly—have been seriously neglected. The same can be said for very large families, and in both cases the problems affect those of moderate as well as low income.

The trend toward concentration of specially disadvantaged groups in central blighted areas is dramatically documented in a recent survey for a San Francisco redevelopment project.[3] In a population of 13,000, 48 percent are Negroes, 13 percent Orientals. Most of the families and 90 percent of the children under 18 are nonwhite. The median family income per month is $400. Most of the white people are elderly, and there are over 4,000 single persons living in flats, hotels and rooming houses, whose median monthly income is $265.

Residential Patterns, Metropolitan Structure and Consumer Choice

In the over-all housing picture of the Bay Area two significant trends are visible, one in the physical pattern *per se,* the other in social patterns and resulting social structure. The physical tendency toward scattered low-density development in outlying areas creates problems which are increasingly recognized if by no means solved: extended communications, costly or inadequate services, a crazy-quilt pattern of local government, weakening of the old centers, and the waste of natural resources and needed public open space. Santa Clara County has led the country in trying to prevent premature or unnecessary destruction of agriculture, with success in some instances but with little enduring effect on the over-all pattern.

The shifting social pattern largely created by limitations in the housing market is almost equally evident: the trend toward sharp divisions by income, race and age between older cities and newer outlying communities. The full significance of this trend is just beginning to be recognized, but it has been documented in Donald Foley's pioneering study for the Governor's Commission. His data suggest that this may be a particularly critical issue for the Bay Area.

[3] "The Population of Western Addition Area 2," prepared for the San Francisco Redevelopment Agency by the Project Service Company, San Francisco, April 1962.

TABLE 8

OLDER AND NEWER CITIES OVER 50,000 POPULATION IN THE BAY AREA: 1960 COMPARISONS

	1960 housing units				Family income		Population Percent nonwhite
	Percent built since 1950	Percent Substandard	Percent owner occupied	Median gross rent (dollars)	Median (dollars)	Percent under $3,000	
Older cities:							
San Francisco	8.4	17.5	35.0	73	6,717	13.5	18.4
Oakland	12.6	15.1	47.5	73	6,303	17.3	26.4
Berkeley	12.9	10.2	44.0	81	6,576	14.4	26.2
Richmond	27.7	11.2	64.4	80	6,851	12.0	22.0
Alameda	9.3	12.8	43.6	75	6,188	18.9	7.8
Vallejo	30.1	14.9	62.5	66	6,606	13.5	19.6
Newer cities:							
San Jose	55.5	10.4	77.1	93	7,330	7.7	3.3
Hayward	75.1	5.8	75.3	97	7,204	7.8	1.5
San Mateo	45.2	3.4	67.8	118	8,236	7.8	6.6
San Leandro	44.5	3.0	77.1	93	7,330	7.7	0.9
Santa Clara	78.8	2.7	75.1	98	7,472	7.2	1.7
Sunnyvale	79.6	4.4	72.6	107	7,937	6.3	1.7
Palo Alto	49.2	4.9	66.6	106	9,132	7.2	4.6
San Francisco-Oakland SMSA	28.4	12.5	54.5	78	7,092	11.9	12.5
San Jose SMSA	58.8	9.3	68.7	94	7,417	10.2	3.2

SOURCE: U. S. Bureau of the Census, *1960 Census of Housing, Final Report HC(1)-6: State and Small Areas: California; 1960 Census of Population, PC(1)-B, General Population Characteristics, no. 6, California; 1960 Census of Population, PC(1)-C, General Social and Economic Characteristics, no. 6, California.*

In their respective proportions of new housing, substandard housing, and nonwhite residents, Table 1 showed some basic differentials between the two central cities and the rest of the nine-county region. In these and other factors, however, the most dramatic break is between the six older cities of over 50,000 population—San Francisco, Oakland, Berkeley, Richmond, Alameda, and Vallejo—and the remainder of the urbanized areas within the two SMSA's, where recent development predominates, and where more than half the families now reside.

Selected characteristics 1960	*6 older cities*	*Balance of urbanized areas*
Proportion of households:		
With incomes under $3,000	14.7%	8.7%
With incomes over $10,000	21.4	27.7
Nonwhite	14.5	2.3
Proportion of population:		
Under 18 years old	27.1	37.8
65 or over	11.0	6.5

In all these categories, Foley showed that the differences between older cities and newer areas were considerably less in 1950 than in 1960. Moreover, if income groups and population under 18 years old were broken down by race, the differentials for white households would undoubtedly be still more pronounced.

In more specific terms, Table 8 compares certain factors for each of the cities of over 50,000 in the nine counties, divided into two groups according to whether or not a third or more of their housing was built between 1950 and 1960. All the other social, economic and physical characteristics follow the same break to a remarkable degree: proportion substandard, proportion owner-occupied, median rent, median income, percentage with low incomes, and above all, the most extreme differential, proportion nonwhite.

These figures should surprise no one: we tend to take this picture for granted, and it obviously reflects the pattern of the housing market. But the implications are not always fully recognized, and for various reasons they may be particularly serious in the Bay Area.

The first group of cities constitutes the older central core of the metropolitan area (except for Vallejo, which is a special case because of Mare Island). These cities contain the only significant supply of cheap housing available in the whole region, including the small units needed by old people. They also contain most of the districts open to ethnic minorities at any price. On the other hand, the newer communities tend to become equally specialized, being occupied by middle and upper income white families normally with children, because this is the market primarily served by the housing industry.

This picture must of course be qualified to some extent. There are still upper-income families in the central cities, and new luxury apartments are being constructed, particularly in San Francisco, but these tend to serve a special and limited clientele of small adult households. Also, there is quite a lot of new rental housing in suburbia, and there may by now be some "filtering up" of lower-income and even minority families in the cheaper tracts of small homes built during and after the war. In both cases intensive analysis of current occupancy would be worthwhile. None of these modifications is strong enough, however, to affect the over-all picture and the dominant trend.

Similar trends are visible everywhere, of course. But the social divisions are particularly marked and potentially serious in the Bay Area for several reasons. In the first place, the in-migration rate is high and the newcomers range from wealthy or highly trained people to the poorest and least educated, the latter coming as always from backward areas in search of new opportunities. Moreover, the in-migrants inevitably include a very large proportion of nonwhites since California's rapid metropolitan development happens to coincide with the great push of Negroes into cities and away from Southern restrictions. The natural growth rate is also high among the lower-income newcomers, in part due to age structure, in part due to lack of education and middle-class values.

On the supply side the restricted market for new residential construction reflects nation-wide trends, but the effect tends to be exaggerated in the Bay Area by growth rates and other local conditions. The volume of recent building is relatively large and most of it takes place outside the older cities, forming an extensive belt of predominantly new cities and unincorporated communities almost wholly occupied by white families in the middle or upper income groups. On the other hand, the stock of housing available to lower income or minority households is relatively small in relation to the ever-rising demand, and is more and more concentrated in the central districts of the older core cities. Thus, in these districts there is a tendency toward chronic shortage and concomitant exploitation, with steady expansion of blight and ghetto conditions.

These geographic and social divisions are sharpened and institutionalized by the governmental structure of the Bay Area, moreover, with its core cities relatively small, circumscribed and dominated by older development. The political divisions tend to promote increasing conflict between central cities and suburban communities, due to rising economic as well as social differentials. The costly welfare and renewal problems are found mainly in San Francisco, Oakland and Berkeley, while the major tax-base increments are outside these cities. In many

ways the suburban zeal for "home rule" is less a reflection of high Jeffersonian principle than it is of a new kind of class warfare or isolationism which bodes ill for metropolitan unification on any voluntary basis. The great historic function of the city, as the essential means of integrating all kinds and levels of people and their activities, has been lost in the scattered one-class enclaves and the ghettoizing older communities.

Finally, recent trends in the residential pattern do not coincide with the shifting location of work opportunities, and therefore make for rising transportation problems. Practically all the increase in industrial, retail and service employment is in the fringe areas, while the central city trend is toward office jobs and highly specialized shopping and services. The 1960 Census provides some information on journey to work patterns for the first time, and Table 9 is taken directly from Donald Foley's study for the commission. It shows that of the 1.4 million working residents of the nine-county area, only 43 percent now have jobs in San Francisco or Oakland. It also indicates that despite housing market limitations the Bay Area has a rather surprising degree of sub-regional integration in the relationship between homes and work places. In the two major cities and in every county a majority of the resident workers have jobs in the same locality. The percentages are as follows:

San Francisco	93.0
Oakland	69.0
Rest of Alameda	62.9
Marin	60.9
Napa and Sonoma	85.8
Solano	89.5
Contra Costa	64.8
Santa Clara	88.7
San Mateo	56.1

These figures suggest that any concept of a large metropolitan region as a single job market or a single housing market is quite mythical. Most people apparently try to live and work in the same general sector, and succeed in doing so to a remarkable degree considering the specialized geography of the housing market. Further Census data will provide more detailed information, but it seems probable that long commuting trips are primarily caused by the lack of suitable housing in the area of employment. This is obviously the case for middle and upper income city job-holders who move their families to distant suburbs. But it is also true for the increasing number of low-income and minority city residents who commute to suburban jobs because there are no homes available to them outside the old districts. The trend toward reverse

TABLE 9

PERCENTAGE DISTRIBUTION OF WORK PLACES, BY COUNTY OF RESIDENCE, NINE-COUNTY SAN FRANCISCO BAY AREA, 1960

(Taken from a study for the Governor's Advisory Commission on Housing Problems, by Donald L. Foley, not yet published.)

Place ol Work	Place of Residence											
	Total Bay Area	Central Cities			Balance of Bay Area							
		Total	S. F.	Oakland	Total	Marin	Napa & Sonoma	Solano	Contra Costa	Rest of Alameda	Santa Clara	San Mateo
Total Bay Area Workers (in 000's)	1,435	494	346	147	941	57	72	50	144	208	234	177
Percentage	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Central Cities	*43.1*	*88.9*	*94.0*	*77.1*	*19.1*	*34.7*	*2.2*	*2.0*	*18.2*	*30.4*	*3.4*	*33.8*
San Francisco	31.0	67.7	93.0	8.1	11.8	34.0	2.1	1.2	7.1	6.4	3.2	33.2
Oakland	12.1	21.2	1.0	69.0	7.3	0.7	0.1	0.8	11.1	24.0	0.2	0.6
Balance of Bay Area	*55.8*	*10.3*	*5.3*	*22.0*	*79.6*	*63.9*	*96.5*	*96.4*	*80.4*	*68.5*	*95.1*	*65.0*
Own County	46.8	....	....	....	71.3	60.9	85.8	89.5	64.8	62.9	88.7	56.1
Contiguous County	7.6	8.3	3.9	18.7	7.2	0.7	9.6	4.4	14.6	4.2	6.3	7.9
Balance	1.4	2.0	1.4	3.3	1.1	2.3	1.1	2.5	1.0	1.4	1.0	1.0
Outside of Bay Area	*1.1*	*0.7*	*0.7*	*0.9*	*1.3*	*1.4*	*1.3*	*1.6*	*1.4*	*1.1*	*1.5*	*1.2*

SOURCE: Mr. V. B. Stanbery for the San Francisco Bay Area Rapid Transit District, June 1962.
U. S. Census of Population and Housing, 1960. Advance printouts of census-tract data.
NOTE: Non-reports have been allocated, except to specific counties outside the Bay Area.
Balance of Alameda County treated as contiguous county to Oakland.
Counties are treated as contiguous in a circular ring around the Bay (e. g., Contra Costa and Santa Clara counties are contiguous to Alameda County), but not as contiguous if any of the four east-west Bay Bridges must be crossed.

commuting is evidenced by the fact that 11 percent of the workers resident in San Francisco and Oakland now have jobs outside. In a more recent study, Donald Foley finds that three times as many nonwhites commute from San Francisco to suburban jobs as come from the suburbs to San Francisco, while the number of whites who come in to work is double the number who commute outward.

Current trends are working against the degree of balance evidenced in the 1960 figures. The proportion of families who can afford new suburban homes has been getting smaller, and the proportion of households excluded for racial reasons is steadily increasing. As the differentials between older and newer communities widen, the range of locational choice gets narrower, not only in terms of job convenience but also in relation to leisure-time tastes. This is true for many middle and upper income families as well as for the disadvantaged.

Future Alternatives: Implications for Policy

The development pattern has in general been following a course which threatens the unique qualities of the Bay Area as a place to live in: its stimulating diversity of natural and man-made environments—of choices and human contacts—at the scale of everyday living. Present trends in residential development, particularly, seem to promote scatteration, standardization, segregation, inconvenience and conflict. This is happening despite higher incomes, despite the increasing acceptance of city planning, and despite valiant efforts to renew central blighted areas. What is likely to happen if these trends continue for another decade or two? And what are the alternatives?

Future Housing Requirements: the Challenge

Population forecasts are necessarily rough, and the 1959 Housing Inventory may or may not provide a sound basis for estimating the factors in future change, particularly replacements. However, the following estimates suggest the general magnitude, at least, of the additional housing likely to be needed in the nine-county Bay Area by 1980.

Total housing units required in 1980 to accommodate projected households plus 5 percent vacancies	2,166,000[a]
Minus total housing units, 1960 Census	1,259,000
Net increase required	907,000
Plus replacements	230,000[b]
Total additional housing units required	1,137,000[c]

On this basis, well over half the two million households anticipated by 1980 will be living in homes which are yet to be built. This enormous volume of dwellings, with the vast network of utilities and neighborhood facilities which must accompany them, will greatly alter the shape and structure of the Bay Area, and the quality of everyday life for all its citizens. Whether the changes will be for better or for worse is still an open question, but some far-reaching choices confront us.

Present Trends Projected

If Bay Area development continues to follow its present course, many of our current problems seem likely to get a great deal worse. The extent of the land that would be more or less "urbanized" if population

[a] Based on household estimates prepared for the Governor's Advisory Commission on Housing Problems from population projections by the California Department of Finance. (Cont. on p, 25)

densities continue to go down at the present rate is staggering. Our two urbanized areas combined covered 795 square miles in 1962, and despite the complaints about "slurbs" this was still only 12 percent of the total nine-county area. But the density decreased by 40 percent between 1950 and 1960, from 6,316 to 3,816 persons per square mile, and, if this trend continues at the same rate, the density would be down to 1,334 per square mile by 1980.[a] With almost double the regional population and practically all of it urbanized (or rurbanized) this would mean about 5,000 square miles of urbanized area, or more than six times as much as there is at present! If it were contained within the nine counties, more than 75 percent of their land would be developed, practically all the farmland would be gone and even the roughest wild country would be largely subdued into private plots by the bull-dozers. "California Going Going . . ." indeed!

Of course this is an over-simplified projection, and market forces alone will probably modify current trends somewhat. But although densities will increase in some locations, it should be noted that our estimates have neglected a rising factor that could be a powerful force in promoting further scatteration, namely, the two-home family with a week-end house. In any case it is evident that a major conflict must be resolved between the endless extension of ever-larger private yards in scattered tracts, and the preservation of our marvelous natural resources for public pleasure, let alone our unique specialty crops such as wine, cheese and fruit.

The social-economic geography of the Bay Area will also present some increasingly serious problems if the market for new housing continues to be as restricted as it is today. Beyond the present fringe there will be a big belt of new houses, so far from the old centers that the pressure to further decentralize their functions will continue to mount. In some of these remote areas there will also be a great many new jobs. Industrial and commercial development will enhance the local tax-base, but the homes will be too expensive for most of the workers and outward commuting will increase.

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[a] According to population projections for the Bay Area prepared by Kingsley Davis, to be published in another Franklin K. Lane monograph, this is a relatively high estimate for 1980 but by no means impossible.

[b] Very tentatively estimated at 8 percent per decade. The inventory showed a loss of 11.5 percent of 1950 dwellings by the end of 1959 for the San Francisco–Oakland SMSA, but this included a considerable proportion of temporary war housing units.

[c] In addition to new construction, this includes a small proportion likely to be provided by conversion, and a small but possibly rising proportion of mobile residences.

[d] Kingsley Davis uses an entirely different method, but the result is similar. His density projections for 1980 range from a high estimate of 1,608 to a low of 1,145.

Some of the cheaper existing suburban tracts, nearer in, will begin to be occupied by lower-income families, and a few will be "block-busted" for minority take-over. The local governments will be too weak and fearful to handle these transitions effectively, and there will be bitter battles, probably with increasing evidence of blight and disorganization.

San Francisco, Oakland and the other central cities will engage in ambitious renewal and redevelopment programs, which will be successful as long as the market for relatively expensive apartments in central districts, primarily for adult occupancy, holds up. But it will be impossible to stem the tide of disadvantaged in-migrants who have no other place to go, and relocation of displaced families will be increasingly difficult. More public housing will be built whether anyone really likes it or not.

The differentials in class, age and race between older and newer communities will become greater. A rough projection of current trends in the racial pattern in relation to probable minority growth leads to the conclusion that San Francisco, Oakland and Berkeley are likely to be around 45 percent nonwhite by 1980.[5] Moreover, the price of suburban housing will tend to keep most low-income and minority households in central cities, even if racial discrimination *per se* is gradually broken down. Ghetto conditions will therefore increase markedly, dampening renewal hopes and seriously hampering the progress of the disadvantaged.

In the meantime, however, the rising disparity between the employment pattern and the housing pattern will become much more pronounced, and the proportion of workers able to live within a reasonable distance of their work—or vice-versa—will be considerably lower. Areas outside San Francisco, Oakland and Berkeley already have well over half the jobs in the region, and a much higher share of the industrial and retail opportunities. Even if these three cities maintain their present volume, they will have only a quarter of the employment in the region by 1980. Moreover, central jobs will be increasingly specialized in business and certain professions, many of them filled by the very people most likely to live in the newest, farthest ex-urbia—displacing the vineyards in Napa County, for instance. On the other hand, if most lower-

[5] Wallace Smith estimated, rather conservatively, that the state's nonwhite metropolitan population would rise from 1,170,000 in 1960 to 2,488,000 in 1980. Assuming the same growth rate, the nonwhite population of the nine counties would be 787,000 by 1980. In the areas outside San Francisco, Oakland and Berkeley the proportion of nonwhites in 1960 was 4.4 percent, located for the most part in older sub-centers and *less* than the 1950 percentage. If we hopefully assume the continuance of this ratio, there would be 241,000 nonwhites in outlying areas by 1980, which leaves 546,000 for the three central cities. Even if they maintain their present over-all population of 1,219,000, which is doubtful, the nonwhite proportion would be 45 percent.

income and minority workers are living in central districts, a great many of them will either have to travel long distances to work or else lose touch with the opportunities for advancement. It is probably true right now that Negroes are not getting their fair share of suburban jobs, because of geographical obstacles as well as discrimination.

The rising differentials will sharpen the political and tax-base conflicts between older and newer communities, and anarchy in the name of "home rule" will force ever-increasing state and federal intervention to equalize fiscal resources and solve the more critical metropolitan-wide service problems. But subsidies alone, however heavy, will not remedy the waste of human resources that comes from ghetto living, or the squandering of natural resources caused by suburban scatteration.

This is not a hopeful picture despite the fact that a great many fine new homes will doubtless be built and a large number of obsolete dwellings may be torn down and replaced. Is there any better way to cope with the future growth of the Bay Area?

The Need for Better Balanced Development: A Conservative View

The structure of metropolitan regions is just coming over the horizon of public and professional concern in the United States, and the variables are only beginning to be explored systematically in academic circles. Communications technology, particularly, suggests a wide range of viable alternatives today, including entirely new forms of urban settlement. If we were looking at the Los Angeles region, it would be tempting to apply some of the revolutionary new ideas. For the Bay Area, however, my personal sentiments dictate a rather conservative Utopia as the best alternative to the unpleasant pattern that present trends are shaping.

What we are throwing away, it seems to me, are all the important qualities that the term "city" has always stood for until quite recently. This is happening everywhere in America, but the loss is particularly significant here because we have had some of these qualities to a rather unique degree, and could preserve them if we tried hard enough and soon enough. In general, these issues have to do with diversity and choice, on the one hand, and balance—or scale—on the other, in terms of three quite different aspects of the urban environment and its organization within the region.

Most obvious is the diversity of experience and opportunity that comes from having both city and country close at hand, urban development and natural or cultivated open space, private yards and public wild areas. We still have this quality to a much richer degree than most large metropolitan areas, at a scale which makes the contrasts visible

and the choices real in everyday life. But this is solely because we have not yet been able to fill in much of the Bay, develop the steeper slopes, tear up all the orchards, or subdivide all the grazing land. Growth and technology will finish the job within the next few decades, however, unless we firmly decide that urban development should be contained within definite boundaries, and also that more compact forms of housing should be strongly encouraged. Open space programs alone will not save much open space.

The second aspect is functional balance, a relatively efficient relationship between homes, work places, and ordinary leisure time facilities. In a small independent city this is not likely to be a serious problem, but in a huge metropolitan area it has to be planned for. Thus far, to many American planners, this has mainly meant bigger investments in freeways and transit systems. But the Bay Area figures indicate that most people do not choose to make long commuting trips unless there are no suitable homes and other facilities available within the same general area as their work, or no suitable jobs reasonably close to their homes. Since employment is already quite widely dispersed in the Bay counties and will become much more so in the future, the problem is mainly in the housing market and its increasing locational limitations. I therefore propose a rather obvious innovation in both planning principle and housing policy: that there should be a varied and relatively balanced choice of housing available, related to local employment opportunities, in each major sub-sector of the region. Of course there would still be long-distance commuting. Individual housing needs and tastes vary enormously and they cannot all be satisfied everywhere. Also, families might not choose to move when they change jobs, and many households include more than one worker. But application of this principle would dispense with a great deal of unnecessary commuting.

Moreover, it would help to implement the third principle for future urban development in the Bay Area. First and foremost, a city has always meant a highly variegated population: rich and poor, young and old, educated and ignorant, people of differing nationality and ethnic stock. This variety was the basic urban resource, cultural as well as economic, and the city had a single government to provide the common services, spread the costs equitably, and resolve the people's differences.

All our older cities—San Francisco, Oakland, Berkeley, San Jose, and many of the smaller communities—were once in the traditional mold. But now our proliferating municipalities tend to be more and more socially specialized, grading upward from the central ghettos to the

latest all-white enclaves in ex-urbia. In the process many of the traditional qualities and functions of urban life have been lost, and new civic problems created. Social differences and resulting conflicts, instead of being resolved by local government, are sharpened and politically institutionalized in the new urban pattern.

Some of the old diversity and balance within cities needs to be restored, beginning at the two crucial points where major developmental changes will take place anyway during the next few decades: the new fringe and the old central cities. In their efforts to retain or attract upper and middle income people, renewal programs are already working in this direction. But their success is likely to be very limited if practically all the additional lower-income and minority people in the entire region must be accommodated in San Francisco, Oakland, Berkeley, and a few other communities, simply because they have no other place to go. Few of the families who do have wider opportunities, particularly those with children, will choose to live in cities whose schools, neighborhoods and governments are dominated by the disadvantaged, and whose tax rates are high for the same reason. On the other hand, many families might like a reasonably mixed and balanced kind of urban community, which is less and less available today whether inside or outside the old cities. Somehow, in addition to whatever filtering takes place in near-in cheaper suburbs, a serious effort should be made to provide cross-section residential opportunities in the cities that will be greatly expanded or started anew on the present metropolitan frontier. In this endeavor civic purposes are supported by strong functional arguments, since most of the additional industrial and service employment will be located quite far out, increasingly remote from central areas.

What this alternative comes down to primarily, therefore, is the channeling of new development on the outer fringe into relatively large, compact and diversified cities, whether entirely new or based on existing communities. This would also permit large neighboring areas of recreational open space and agriculture to be preserved from the bull-dozer. Each of the cities would reflect some degree of balance in population, employment, community facilities, and economic base, but they would vary greatly in size, density, functions, population mix, and particular character. There would still be a great deal of movement among the cities, and between new and old communities, not only for work but also for the vast array of services and leisure-time activities—from universities and wilderness hiking to financial advice and Bohemia—which no one place can provide, and which help to give each

place its special character. The regionwide functions of San Francisco and Oakland would probably be strengthened, and renewal programs would be easier to carry out.

The guiding purpose would be no rigid formula, but to *maximize individual choice:* in housing and jobs, in public and private recreation, in natural amenity and urbanity, in life-styles, social contacts, cultural opportunities and convenience. It will be argued that a great many people apparently choose to live in low-density one-class communities. This is true, and it is also true that a large segment of the minority population prefers a separate community life: urban in-migrants have usually maintained strong national, religious or racial groups for at least a generation, even when there were no restrictions on their movement.

But increasingly, these are the *only* choices available. And there are other kinds of people with different tastes: families who would prefer San Francisco to the Peninsula if housing and schools were better; people who are bored with rurban homogeneity or tired of long-distance commuting; Negroes who want to be ordinary Americans. For these, and many others, we need to offer new alternatives. And the present choices will still remain. The vast expanse of postwar suburbia will be there for those who like it, and there will be predominantly nonwhite communities in the suburbs as well as in central districts. But they will not be "ghettoes" in the sense that no other choice is open, and this can make an enormous difference in the social and political climate of the Bay Area, particularly at a time when Negro leadership is wavering between the old goal of integration and a new push toward achieving power and dignity by militant separatism.

New Directions in Bay Area City Building

Although our proposal for future development runs counter to postwar trends in America, it is not inherently impracticable or revolutionary, and there are already some signs of positive steps in this direction.

In most countries of northern Europe, postwar suburban development has tended to follow these principles quite effectively in one form or another. Whether in the New Towns of Britain or in the big satellite communities of Amsterdam, Rotterdam, Stockholm and Copenhagen, it is taken for granted that urban development should be contained within predetermined limits, that various types of housing must be provided to serve all social and income levels, that homes should be reasonably convenient to both employment and permanent open space, and that corporate unity is essential, whether as an extension of the central city or for diversified independent communities.

No European country is wielding more powerful tools or larger subsidies to achieve these purposes than we are already applying to the problems of renewal, redevelopment and rehousing within our older cities. But we have not yet tried to translate these powers and precedents into instruments that would be effectively applicable to new development. Suburbia is largely shaped by numerous federal, state and local policies related to housing, by public works of all kinds, and by planning, zoning and other land-use controls. But these decisions are made in bits and pieces, unrelated to any broad determinations of public purpose. The need to overcome this curious lag is particularly evident in California, where growth is obviously the dynamic force that shapes the future, while renewal problems are mainly the result of misguided growth patterns and cannot be solved without changing those patterns.

There is a new interest in the shape and structure of California's future development, however, and significant innovations have occurred in both planning and practice in the Bay Area. In some ways the Rapid Transit Plan, for instance, could help to promote the pattern here envisaged *if* the system were rapidly extended to the outer counties. This is because the plan was consciously designed to discourage scatteration and to induce major suburban concentration, as well as to "save" the old cities.

With or without mass transit, however, the clearest image of the pattern I propose was set forth three years ago in specific visual terms by a Bay Area planner, Karl Baruth.[6] His basic principle is that residence and employment should be related in urban centers of substantial size, which would form a regional network. By extending his scheme to a wide area, including Sacramento and Monterey Bay, he demonstrates that the region can even take care of 15 million inhabitants quite happily and conveniently by the year 2010, without losing it natural amenities, if it chooses to expand on the principle of balanced city development rather than chaotic scatteration.

The implications for housing and land policy, and for governmental structure, are not discussed in either of these plans, but the problems become apparent when we look at some of the current city-building efforts in the Bay Area. For a number of practical reasons, there is a positive push toward large-scale urban development. The word "city" has become fashionable again. Sometimes this only means huge glittering retirement communities for the wealthy aged, cities as narrowly specialized as cemeteries. Quite frequently, however, there is an effort to achieve real cities in the more traditional sense, with multi-purpose

[6] Karl H. Baruth, *The Northern California Metropolis* Palo Alto: The National Press, 1960.

social and economic functions. Two entirely different examples of this new trend are Fremont and Foster City. Still another type is Santa Cruz, an old community that will be forced to become a large town rapidly by the development of its new University campus. In all these cases, it is recognized that a balanced, diversified city is desirable, and that advance planning is necessary. But there are a number of serious obstacles which will militate against success unless some new tools are made available very soon.

When it was incorporated less than a decade ago, the City of Fremont in southern Alameda County presented a unique and obvious opportunity to create a large multi-purpose city. The area that became Fremont was relatively undeveloped and did not have the social cachet of the Peninsula. When the enlightened citizens of several scattered rural communities boldly incorporated a huge realm extending from Mission Peak to the Bay, they envisioned a real city and hired first-rate planners to carry it out. The Rapid Transit Plan has mapped a station for Fremont, further strengthening its possibility of becoming a major regional sub-center.

But what has happened in the meantime? A sea of standard suburban tract houses has been occupied by white families, with a few nonwhites still hanging on in the older communities. Industries are coming in, but many of their employees will have to commute from Oakland, which will pay for their schooling and services. Land speculation is reducing the possibility of preserving the open space originally planned for, and land prices are forcing up home prices. Zoning allows, and the land market induces, some multi-family housing. Also, a mixture of dwelling types is officially encouraged through "planned unit development" schemes. But the community is already so clearly a specialized enclave for a narrow range of middle class families that top industrial management may choose to commute from the Peninsula. There are distinguished plans for a civic, cultural and business center, but Fremont is unlikely to achieve a much greater degree of urban quality and opportunity than the general run of suburban communities, unless a new set of tools and criteria can be applied to the remainder of its development. And this is much more difficult politically now than it would have been at the start.

Foster City, beginning to emerge from the marsh on Brewer Island in San Mateo County, exemplifies another type of city-building initiative which is currently on the increase, by a single large-scale landowner and developer. With its 2,700 bayside acres, its lagoon system and potential State Park, Foster City will be a distinctive piece of urban geography, both visually and for its recreational attractions. It was also

intended to become a relatively balanced community. According to the *Foster City Preliminary General Plan Report,* "the City will accommodate 35,000 people representing a cross section of San Mateo's population both in income and family size. 40% of the housing will be in apartments and 60% in single family houses. [It] will provide a balance between working and residential areas so that most of the residents could find work within the community if they choose." About 12,000 persons are expected to be employed in the city, half of them in an industrial park.

But what is happening in practice? The lowest-priced single-family home is now expected to be $19,000. The implication hardly needs to be documented, but a little survey has been made of income requirements for home finance, and also of the wage levels in likely types of local employment.[7] The result indicates that hardly 30 percent of the workers, even assuming high-wage industries and research operations, could afford such homes except where there is more than one worker per family. Multi-family dwellings may turn out to be somewhat cheaper, but probably only in units not suited for occupancy by families with children, unless there are major innovations in design.

Land reclamation for Foster City is expensive, and the heavy initial outlays for capital improvements are always an obstacle to city-scale development by private enterprise. But the California Legislature created a municipal improvement district, whose tax-exempt bonds are sold to finance capital improvements, and which will administer the community until it is incorporated as a city. This device has a dubious history, however, and the state is likely either to abandon it in the future or subject it to greater public control.

Santa Cruz might seem to be an easier challenge. At least it has some older housing which may help to provide shelter for lower-paid faculty and staff in the early years. In this respect it is better off than the projected community of the University's Irvine campus in Orange County. Sooner or later, however, the limited market for new housing will pose serious problems. Moreover, the land required for urban expansion (to five or ten times the present population of Santa Cruz) is largely unincorporated, and in ownerships which have no compelling interest in the proper over-all development of the area. This is a disadvantage for Santa Cruz, by comparison with Fremont on the one hand, and with both Foster City and Irvine on the other. Neither the city nor the University has any direct control, and however cooperative

[7] Richard Chylinski, "Residential and Industrial Analysis of Foster City," (unpublished seminar paper, Department of City and Regional Planning, University of California, 1963).

the county planning office may try to be, the California county has very weak powers for the guidance of urban development. The land is extraordinarily beautiful, and the campus itself will be an added magnet. There is nothing to keep it from being surrounded by country homes for the wealthy, or by dude ranches. The faculty would just have to live somewhere else, as the UCLA faculty do now for similar reasons. And even Irvine, with the whole enormous area in single ownership, planned as a unit, is seriously jeopardized by the threat of piecemeal and strip annexations which neither the University nor the Irvine Company can prevent except by indirect political pressure. The danger of this kind of chaos is perhaps even greater at Santa Cruz.

The immediate outlook for balanced, well-organized cities in the outlying fringe of the Bay Area is not very hopeful, despite the varied forces and arguments which push in this direction. But the issues are beginning to be clarified, and the necessary but neglected role of the state in guiding urban growth is increasingly recognized. Indeed, the state's direct interest and huge financial commitment in the new University communities is dramatizing these issues in Sacramento.

Toward State Policy for Urban Expansion?

Another paper as long as this one would be required to describe the federal, state, local and private measures currently proposed to remedy weaknesses in housing practice, urban development and metropolitan organization. Hoary principles and long-accepted methods are coming under critical scrutiny, and we may be approaching a period of innovation in dealing with our expanding environment.

At the federal level, the narrow emphasis on slums and central renewal (while FHA and the Bureau of Public Roads blindly helped to create our present suburban problems) has been shifting to a broader focus. California's new prestige as the biggest state may have had some influence on this change. As the Governor's Advisory Commission on Housing Problems states:

> One of the obvious deficiencies of the federal effort is that it is both inadequate to California's needs and largely irrelevant to its situation. California requires aid for growth as much as it does for clearance. While the urban renewal program is needed by California's older cities, its main concern should be to prevent the slums before they form. California's communities, in short, require new tools and new techniques for land development and housing of all kinds to serve the needs of the future.[8]

Positive results of the federal shift thus far have included increasing aid and encouragement for metropolitan and statewide planning, and

[8] *Housing in California,* 1963, p. 48.

a program of loans and subsidies for the acquisition of permanent open space in metropolitan areas. Now the principle is gradually taking shape that the whole kit of federal-local tools created to carry out comprehensive renewal programs in blighted areas should be adapted for wider use in new development. This would include aid for land acquisition by suitable public or private agencies, for land improvements, and for certain types of private housing to reach middle- and lower-income families. How to re-tool the old public housing program to meet a wider range of social and civic needs more efficiently, with greater acceptance and less bureaucracy, is still an open question. But the demonstration program enacted in 1961 provides an opportunity for free experiment with housing subsidies which, if fully exploited, might point the way to new solutions. And the Executive Order provides a boost for open occupancy in all new federally aided housing, which may help to break the barriers in suburbia.

At the opposite pole, local government in the suburban communities which predominate in the Bay Area has hardly begun to face up to these issues, and the Association of Bay Area Governments is likely to ignore most of them even if it succeeds in producing a "regional plan." Unadulterated "home rule" for every little enclave is still defended with righteous fervor, but the Committee on the Future of the League of California Cities shows significant signs of rising concern and sophistication on certain aspects of this basic question.

It is at the state level, and properly so, that the most promising activities and proposals are coming over the horizon. The 1961 reports of the Governor's Commission on Metropolitan Area Problems opened up the broad issues of governmental organization and regional planning, but achieved no immediate results in legislation. Now the Governor's Advisory Commission on Housing Problems has shown that housing, renewal, and related social and civic problems cannot be divorced from basic questions of urban structure and the pattern of metropolitan growth. Its recommendations are prefaced by this statement:

> If we have learned anything from the history of cities in America and Europe, it is that a city must provide for people from all walks of life. This *is* a city by its very definition and organization. If this lesson is to be carried over to California's new communities in which most of the five million new homes will be built, California's new cities must provide a place for the settlement of industries and of all people dependent on them and for the secondary services connected with city life. It must provide for those formations before the fact, not after, if these cities are to grow and remain sound in the long run.[9]

[9] *Housing in California,* 1963, p. 48–49.

The commission's various proposals add up to a comprehensive state policy for urban expansion and renewal. This would provide the missing link between numerous federal and state programs which affect development, and local governments which have not as yet created institutions capable of guiding growth effectively.

The State Office of Planning would be strengthened to coordinate state and federal programs in relation to the statewide development plan now in preparation, and in relation to regional plans which would presumably be prepared by the state where no suitable regional agency has been established. The State Office of Planning would also analyze annexation and incorporation problems and develop standards to rectify the present chaos. This will pose the basic question: What *is* a "city"?

The commission recommends a number of modifications and innovations in federal housing, renewal, and land policies to fit California's needs and conditions, with emphasis on a "program to aid states in the proper development of new areas." The state legislation against discrimination in housing would be strengthened, and administered by the Fair Employment Practices Commission. And a new Housing and Development Agency would be established. This agency would provide the necessary link between Washington and the local communities, and would administer a supplemental program of state aids and inducements to provide suitable housing where needed, and also for urban land acquisition and development, including the creation of new towns.

All this is unlikely to be enacted overnight, and the commission recognizes that it would be wise to tackle some of these innovations on an experimental basis:

> The building of new towns could be undertaken first on a pilot basis through the new Housing and Development Agency . . . with a revolving fund. . . . Loans might be granted to counties for the purpose of developing new communities. . . . Cities with open land should qualify for loans enabling them to expand in a natural manner. In cases where there are no qualified local agencies, the Housing and Development Agency should be able to proceed directly or through corporations chartered by the new agency to carry out the works. The first new town might be built in connection with a state improvement such as water, a university development, or road building, but this is not mandatory.[10]

The question may well arise: Should such a pilot project be encouraged somewhere in the Bay Area or its environs? Should we mobilize the best knowledge and tools available, the strongest public and private leadership, to create the kind of city—whether entirely new or expanded from an older community—which would preserve and enhance the best qualities of our region?

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[10] *Housing in California*, 1963, p. 62.

VII

RICHARD M. ZETTEL

URBAN TRANSPORTATION . . .

Urban Transportation in the
San Francisco Bay Area

The San Francisco Bay Area and Its Major Urban Transportation Facilities - Existing and Proposed
NAPA CO
Santa Rosa
MARIN CO
SOLANO CO
Novato
Vallejo
San Pablo
Antioch
Oakland
San Francisco
CONTRA COSTA CO
ALAMEDA CO
Livermore
SANTA CLARA CO
San Jose
SAN MATEO
SANTA CRUZ
Santa Cruz
80
580
680
280
N
SCALE
5 0 5 10 MILES
LEGEND
Authorized Rapid Transit System
Possible Rapid Transit Extensions
Proposed Bridges
Commercial Airports
California Freeway & Expressway System
Other State Highways
Traversable Route
Unconstructed Route

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University of California • Berkeley, California
DWIGHT WALDO, Director

Urban Transportation in the San Francisco Bay Area

BY
RICHARD M. ZETTEL
Institute of Transportation and Traffic Engineering

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Major Urban Transportation Facilities in the San Francisco Bay Area: Existing and Proposed . . . . . *Frontispiece*

Introduction

The San Francisco Bay Area is a wonderland for the careful student of urban transport problems. For the not-too-grim, the "jewel of the Pacific" with its ring of cities and suburbs around the Bay is fascinating and exciting, what with its contrasts and controversies, its propensity to look forward and backward at the same time, its vacillation between the bold and the timid.

For those unfamiliar with the region, disparate descriptions of current developments in urban transportation in the Bay Area are doubtless bewildering. One may read that the Bay Area has rejected California's love affair with the automobile and freeway, and has become the nation's foremost pioneer in truly modern rapid transit. On the other hand, one may read that the San Francisco Bay Area is busily engaged in building one of the world's great highway transportation systems, consisting of magnificent bridges, fully integrated freeways, and supporting road and street arterials, with mass transportation still regarded as a dubious quantity, supplemental at most.

This paper will attempt to dispel some of the confusion by describing current realities of the transportation situation and speculating about recent trends and future developments. It might be useful first, however, to establish quickly the physical and institutional setting of the area.

This Place Called San Francisco

In some contexts the Bay Area is said to consist of thirteen counties; in others of as few as five. The Bay Area rapid transit system, as presently planned, will serve three of the counties. Nine counties, the number usually settled upon in dealing with urban transport problems, are treated as "the Bay Area" in this paper (see map, frontispiece). The area includes some 7,000 square miles, with the would-be Queen Mother, the "City" itself, occupying only seven tenths of one percent of the land, housing less than one fifth of the residents, and supplying about one fourth of the jobs.[1]

The region is blessed with a variety of salubrious climates, among which one may literally choose his own, complete with built-in air conditioning. Its hills lend enchantment and scenic wonder. It is endowed with great natural assets, above all the great "blue belt" of the Bay itself. Lying as it does on the median line of Pacific Coast population, agriculture, industry, and finance, the Bay Area is a vital force in the expanding West.

It is truly a vibrant place, being foremost in tonnage of water-borne commerce on the Pacific Coast, being served by four Class 1 railroads and more than 100 common carrier truck lines, and standing second on the Coast and fifth in the country in air passenger traffic. Its nearly 4 million residents are said to have the highest per capita net effective buying power in the United States.[2] Its population has more than doubled since 1940, and has increased about 36 percent between 1950 and 1960. Estimates vary as to the future, but one widely used forecast puts the 1980 population at 6.6 million, more than 70 percent over 1960. The high hope is that everything else will burgeon more or less accordingly, though it seems likely that problems, especially transportation problems, will multiply at an even more rapid rate.

This place called San Francisco actually contains, in addition to the nine counties, some 80-odd cities, six large special districts of government, and hundreds of smaller ones. Thus, it is an area divided by political as well as economic rivalries. Transport functions are fragmented and dispersed among many units and layers of government.

In this area, counties and cities have individual jurisdiction over

[1] In this paper, the term "San Francisco" will often be used to designate the entire nine-county area. Most Californians and many others will know that another common usage of the term "San Francisco" refers only to "The City": that tiny tip of the peninsula which one wag (undoubtedly from Los Angeles) suggested be fenced off as a state historical monument.

[2] San Francisco Chamber of Commerce, *San Francisco and the Bay Area,* 1961.

roads and streets, while the State Department of Public Works has full responsibility for urban freeways and a few other highways. In this area, the California Toll Bridge Authority oversees six of the Bay's bridges, but the aesthetic gem of them all—the Golden Gate—is managed by a special district. All are under the watchful eye of the U. S. Corps of Engineers with its jurisdiction over the navigable waters. In this area, two public transit systems and two major corporations (plus some smaller ones) are currently offering mass transportation service, while a new district without any present operations at all is preparing to provide regional "space age" rapid transit within the decade.

Vaunted as "the city that knows how," its "know-how" sometimes seems devious and obscure. In this area, two of the world's great and beautiful bridges can be built simultaneously in the depth of depression, but an unsightly swayback can be constructed in highly prosperous times. A somewhat scorned structure—the Ferry Building—is found by many to be a precious historical monument *after* an elevated freeway partially obscures it.

In this area, the San Francisco County board of supervisors rejects portions of the trafficways plan drafted by its own planning commission, even after intensive restudy and reappraisal. This leads to the peculiar circumstance that certain major routes are in the superhighway plan of the federal government, but are excluded from California's own freeway and expressway system.

A Golden Gate Transportation Commission is proposed, but rejected when its only agreed-upon function is asserted to be collection of money at the toll bridge plazas, sometimes called the cash registers. In this same area, however, a magnificent newly-built airport complex stands underutilized for want of sufficient air traffic, while short miles across the Bay new airport structures are being feverishly erected to handle overloads.

A voluntary organization of local governments is created in the area, allegedly to head off any possibilities of metropolitan government, and finds itself aspiring to perform "the regional planning function," thereby becoming something of a "metro" unto itself. But this organization, the Association of Bay Area Governments, has had to worry along during its first two and one half years without membership of the area's two largest cities—San Francisco and Oakland.

Surely, then, this is an area with the usual quota of transport coordination problems, perhaps somewhat aggravated by unusual setting and topography. Yet this is also a challenging area upon which many eyes of the urban transport world are focused. In part of the Bay Area, the public has recently contracted by popular vote to pay four fifths

of a billion dollars (and another half billion in interest) out of property taxes on a grand experiment aimed at reversing transportation trends by building a *"modern"* rapid transit system, albeit one which would still run on two tracks over, on, or under the ground.[3] And this has happened in the state which many would have us believe has gone wild with automania.

[3] The district presently consists of three counties, but has hopes for expansion. Originally a six-county proposal, one county wrote itself out of state enabling legislation, another withdrew voluntarily, and one had to be coaxed out of the district when a panel of engineers decided the Golden Gate Bridge could not be modified to carry transit trains.

Different Views of the Current Outlook

The many eyes viewing this great Bay Area experiment in urban transport wear glasses of varied colors.

The Rosy View

The rose-colored glasses show a city come to its senses: a city that has out-reasoned the follies and foibles of the smog-laden metropolis 400 miles to the south; a city that has discovered automania to be incurable because its treatment aggravates the disease. They see a city that need not outlaw the automobile because it outlaws the "land-eating" freeway upon which it breeds.

The tax cost of transit is not really alarming. The widespread benefits will outweigh the costs. In any event, transit is a more economical solution to urban transportation problems than highways. Besides, it might be well to get started on transit as a simple matter of "one-upmanship." For surely the federal government will come in to help out. In addition, a drive is being made to get motor vehicle tax funds to ease the load.

Here then is a courageous city that now lights the way to the better cosmopolitan life by providing the means to overcome "slurbanization." For in this good new life people will be able to ride transit trains at 50 miles an hour—70 M.P.H. between stations—in safety and comfort, arrive at work relaxed and at home cheerful, all the while having been edified by reading one of the local papers, or perhaps even the *New York Times* (Western Edition).

Beyond this, the optimistic eyes foresee "large nucleated, high-intensity business districts in appropriate locations" brought about by the influence of rapid transit. All in all, they see a more desirable pattern of urban development.[4]

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[4] Advisers to the Bay Area Rapid Transit Commission stated that the alternative to rapid transit was "the alternative of dispersion." Without saying exactly why, they concluded: "We think that the most desirable pattern of organization would be founded upon a system of nucleated centers of commercial and cultural activity." Parsons, Brinckerhoff, Hall, and MacDonald, *Regional Rapid Transit, 1953–1955*, (A report to the San Francisco Bay Area Rapid Transit Commission), 1956, p. 19.

One wonders how many voters realized that they might be confirming this choice for themselves and posterity when they cast ballots on the rapid transit bond proposal.

The Dark View

The gray glasses shut out these lights—they reveal a somber scene. Here is a city taking leave of its senses. Here is an area gambling a good billion and a half of tax and toll dollars on sentiment and nostalgia, victimized into a giant boondoggle by a "Madison Avenue snow job." Here is an area that ignores trends in transit riding, putting in fixed rails when only flexible transportation—cars and buses, freeways and roads—will serve the people's needs and desires. Indeed, here is a city preparing to put rails in a subaqueous tube near a bridge that is even now being converted to all motor vehicle traffic, only recently having had rails removed from its lower deck.

Here is a city that would emulate Manhattan without knowing that Manhattan, too, is experiencing congestion, decentralization, and suburbanization. And, after all, what is so wrong with the decongested suburb, the spacious factory, and the commodious shopping center? Not even the Los Angelenos are demented simply because they enjoy detached single-family dwellings, lawns, swimming pools and barbecues. And why should all this be given up simply to mollify those who somehow seem to equate all that is crass in contemporary society, including the obnoxious billboard and the screaming commercial, with the supreme villain of the piece—the automobile.

Other Shades

Other eyes wear still other glasses. There are the hedgers on "balanced transportation," those who would have "just enough" of both freeways and rails; if one system fails, the other will be there to cover the error.

Of course, those who have prospered from massive highway building in the Bay Area may expect to profit from the transit program as well, however legitimately, at taxpayer risk. Financial institutions and investors can hardly blind themselves to another billion in tax-exempt bond sales. Steel fabricators, equipment builders, contractors, other businesses and utilities, are not oblivious to the promise of the future; nor, for that matter, are steel, construction and other workers in the labor force. If fortunate property owners have enjoyed windfall gains because of highway improvements at the urban fringes, downtown land owners can now cross fingers for the success of transit in recentralizing activity and enhancing central values. City fathers eagerly seek enlargement of the property tax base.

And, finally, there are those who just *know* that "something has to be done." Many of them supported California's big highway efforts of the 1940's and 1950's, but find urban freeways still full at peak hours. They are disillusioned and ready to construct "something else" for

other people to move on. Many of the avid transit advocates never really expect to ride it, but would have it for others, so that they themselves may travel in the privacy and comfort of their own cars.

Clearing the Lenses

Surely, one will say, there must be many whose lenses are not so colored. And indeed there are. A move is already under way, supported by community leaders and transportation specialists, *including both highway and transit officials,* to undertake a major comprehensive regional transportation study for the Bay Area—a study looking toward the initial preparation of a regional transportation plan and the development of a continuing transportation planning process.[5]

We might ask how these observers view the problems and prospects ahead.

First, they are fully aware that voter approval of the rapid transit system bonds was not the beginning of the end of the Bay Area's urban transportation problems.

Second, they see too many hands at the wheel of urban transport policy. There is acute need for coordination based on a large overview of transportation requirements, now and in the projected future.

Notwithstanding that many transportation plans have been drawn up—by the State Division of Highways for freeways; by counties and cities for roads and streets; by the State Division of Bay Toll Crossings for bridges; by the Rapid Transit District for transit—a need is seen for integrated transportation planning on a regional basis.

Proponents of a new comprehensive study for the Bay Area emphasize the need to give full recognition to the interrelationships between all transportation modes and facilities. They emphasize that the interactions between land use and transport development, given little more than lip service in the past, should actually be built into the transportation planning process.

Hard study should be given to the question of how transportation can or should be used to shape as well as to serve land use development. To the extent that alternatives are possible, each should be evaluated as to its total consequences and weighed against all others. The "policy makers" will have to make the final judgments and trade-offs between measurable and intangible values after testing alternatives in the crucible of public discussion.

It is recognized that in order to draw up meaningful plan alternatives, consistent and acceptable projections of population, economic

[5] California Highway Transportation Agency, *Prospectus for a San Francisco Bay Area Transportation Study,* October, 1962.

activity, land requirements, and technological change must be prepared. Attention should be given to the potentials, especially timing and economics, of novel forms of urban transport—hydrofoils, personal aircraft, flying belts, carveyors, and the like. Also to the less spectacular but more probable developments—vehicle guidance systems, improved traffic control systems, new vehicle power systems, standardized containerization, and the like.

Changes external to urban transport itself may have a considerable impact on future requirements—as one example, possible increases in the substitution of communications for transport. And further afield, the increase in productivity resulting from automation and other developments will have a decided impact on transportation. Consider, for example, the effects of alternative distributions and expenditures of higher personal incomes and greater leisure.

Proponents of regional study understand and insist that the building of many transport facilities, including transit as well as highways, should not be stopped nor even slowed while data collection, analysis, and plan preparation go on. They accept the fact that certain commitments and near-commitments need to be carried out, and will fit into a regional transportation plan in any event. But they are also looking to the longer range future of the 1970's, 1980's, and beyond. They know that one generation often gets what the previous generation planned for. They have hopes that new methodologies and computer techniques have made possible better projection and planning for the future.

These matters for the long future will undoubtedly be dealt with intensively in the proposed transportation study—which might take as long as four years—if it lives up to expectations. This paper would be much easier to write but would probably be superfluous if these studies were completed. Yet many things are going on right now, and others are bound to occur soon, which will have a profound influence on transportation and other developments in the San Francisco Bay Area. Perhaps we should lower our sights to the present and scan the horizon to circa 1980 for a closer look at transportation trends and possible developments during the next 20 years or so. We can start with an examination of the over-all growth picture and go on to consider the separate transportation facilities, that is to say, the Bay crossings, urban freeways, roads and streets, and transit systems. We may then have a better idea why comprehensive regional transportation planning seems so essential.

Growth and Transportation in the Bay Area

Discussions of current and future growth trends in California and in the Bay Area are so nearly redundant as to become wearisome. But they can hardly be avoided. For the problems of future growth—in population, economic activity, land use, etc.—lie at the very heart of the urban transport problem. Not only are facilities needed to serve growth, but they will tend to shape it.

The adjustment of transport capacity to the requirements of the future is a tedious process involving long lead times in planning, in making political and financial arrangements, in acquiring rights-of-way, and in actual design and construction. Problems that are difficult enough for *individual* projects, are magnified for *systems* of facilities—a freeway system, for example—and compounded even more for the articulation of *complementary systems*—highways and transit, for example.

In looking to the future, population growth is, of course, the most important consideration.[6] People travel in work and play. And people produce and consume the goods and services that must be moved about to satisfy their wants.

Population Growth

The 1960 population of the Bay Area was 3,640,000. This was more than double the 1940 population, and 36 percent higher than the population in 1950. The Bay Area added almost a million to its population in ten years.

There is no single authoritative projection of population for the Bay Area or its individual counties. However, we do have some rather widely used estimates which reveal general trends adequately for our purposes here. These may be compared as follows:

	"2020 Report"[a]	Stanbery[b]	Dept. of Finance
1970	4,314,000	4,808,000	5,007,300
1975	.....	5,415,000	5,786,000
1980	5,729,000	6,020,000	6,600,000
2000	8,261,000	.....	.....

[a] U. S. Department of Commerce, *Future Development of the San Francisco Bay Area; 1960-2020*, December 1959. (Prepared for the U. S. Army Corps of Engineers)

[b] Stanbery's estimates appear in San Francisco Bay Area Rapid Transit District, *The Composite Report*, May 1962.

Although the future numbers are large they do not appear extravagant in light of past rates of growth. For example, the actual population increase between 1940 and 1960 was 110 percent; looking ahead 20 years the "2020 Report" shows a 57 percent increase while the Stanbery estimate shows a 65 percent increase. The most recent estimate to come to our attention (February 1963) is by the State Department of Finance and indicates a nine-county Bay Area population of 6.6 million in 1980, 10 percent more than the other high figure shown above.

In many metropolitan areas there is concern as to whether prospective growth can be accommodated without serious over-crowding of the land. There is also concern about the land appetite of the automobile as reflected in its consumption of space for freeways and terminals.

The "2020 Report" gave some attention to problems of this kind as they might affect the Bay Area. It was estimated that about 52 percent of the total land area of the nine counties is potential urban land (some 3,633 square miles). Of this amount, only 538 square miles (15 percent) was developed for urban uses in 1958. It was estimated that the total developed urban land would increase to 898 square miles in 1980, an increase of 360 square miles over 1958, but still less than 25 percent of the potential. In 2020 some 2,389 square miles of the area would be in urban development, about two thirds of the urban potential and about one third of the total land area.

Taken at face value these figures seem to suggest that the Bay Area will encounter no serious problem in the next half century in absorbing anticipated population growth, while at the same time providing space for highway and other transport facilities. Much of the concern over the "disappearing land" may be born of an innate aversion to urban sprawl, and possibly to the motor vehicle which makes it possible.[7] This is not to say, of course, that spreading out willy-nilly over the far reaches of the landscape or filling in the Bay, or both, is a desirable pattern of land development.

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[6] Any projection of population must assume an underlying level of economic activity adequate to sustain it. It is not implied that independent evaluation of the economic base of the region is unimportant. In fact, an economic study is an essential crosscheck on population forecasts. Moreover, economic analysis may indicate changes in productivity, in mixes of goods and services, and in incomes and leisure, which will exert material influences on urban transportation demands.

[7] The question of urban encroachment on agricultural lands is beyond the scope of this paper. It may be noted that agricultural land in the area would be reduced from 4,378 sq. mi. in 1958 to 2,810 in 2020, a loss of some 1,500 sq. mi., according to the estimate. In considering agricultural land losses, one must consider increasing productivity in agriculture, the improvement of lands through fertilization, reclamation, and the like. A number of studies, apparently authoritative, suggest that there is no cause for great alarm over the encroachment of urban growth on agriculture in the foreseeable future.

It is significant that the land-use projections were based not only upon completion of the freeway system now planned by the state, but that "extensions of these plans to the end of the study period had to be presumed." In addition, the projections were "based on the assumption that an extensive mass transportation system would be provided in the future," specific reference being made to the proposals of the San Francisco Bay Area Rapid Transit District.

Population Distribution

It is somewhat surprising that analysts found it possible in the "2020 Report" to ignore the impact of transportation development on the distribution of population within the area. They stated:

> In making the land-use projections, it was not considered necessary to solve one of the basic problems of whether or not commutation would be to central work areas or to highly localized neighborhood work areas. In either case, the residential areas will be built up for the expected population growth and would be related to industrial use of the land. (p. 61)

The meaning of this statement is not entirely clear. It seems to imply that residential development will take place where land is available, and workers will find a way to get to their jobs. Somehow this tends to

County	1960 Population	Growth Ratios				
		1940–60	1960–1980			1960–2000
			(a)	(b)	(c)	
Alameda	908,300	1.77	1.48	1.49	1.49	2.02
Contra Costa	409,000	4.07	1.62	1.89	2.09	2.70
San Francisco	740,300	1.17	1.20	1.01	1.02	1.33
Three counties	2,057,600	1.65	1.41	1.38	1.44	1.91
Marin	146,800	2.78	1.75	2.38	2.45	2.75
San Mateo	444,400	3.97	1.61	1.80	1.93	2.28
Five counties	2,648,800	1.87	1.46	1.51	1.58	2.02
Napa	65,900	2.31	1.91	2.00	1.74	3.69
Santa Clara	642,300	3.67	1.84	2.10	2.59	2.63
Solano	134,600	2.74	1.82	1.93	1.85	3.18
Sonoma	147,400	2.13	2.10	1.95	2.14	3.80
Nine counties	3,639,000	2.10	1.57	1.65	1.80	2.27

(a) "2020 Report" (b) Stanbery (c) State Department of Finance

suggest a blind faith, perhaps not entirely unjustified in light of past experiences, that transportation facilities will be provided willy-nilly to supply the necessary links between homes and jobs. But this kind of attitude will surely be disconcerting to planners and others who believe in a "range of effective choice" within which transportation planning can exert a material influence on land use development.

In any event, population forecasters see a considerable difference in rates of growth among the several counties in the Bay Area. Certain data may be summarized. (See table, p. 12.)

Looking to the comparative figures for the 1960–1980 period, we see some startling differences in projections for many of the counties. A coordinated Bay Area planning effort would have to find a basis for reconciling the forecasts.

It will also be seen that San Francisco and Alameda counties, currently the most populous, are expected to grow at slower rates than other counties, both to 1980 and to 2000. Actually, both the City and County of San Francisco and the City of Oakland (in Alameda County), the area's second central city, lost population between 1950 and 1960. There was an absolute as well as a relative decentralization of inhabitants during the decade. However, this was not an unusual occurrence among the larger metropolitan areas of the United States. A recent survey of 27 metropolitan areas reveals that in 11 cases the central cities lost population between 1950 and 1960. Among the other 16 areas surveyed, the central cities in 14 gained population at a lesser rate than the surrounding areas during the decade; in only 2 areas did the rate of central city growth surpass that of the rest of the area.

Commuting

The separation of homes and jobs gives rise to the commuting problem. And the regularized diurnal movements to and from work give rise to "peaking," which is the crux of the urban congestion problem. The rapid transit district, for example, estimates that 80 percent of all commuting takes place during four hours of the day: between 7 and 9 a.m., and 4 and 6 p.m.

Data on total commuting in the Bay Area are rather sparse, and projections for the future highly speculative. The 1960 census, however, produced some evidence that workers do attempt to locate in the general area of their employment. In the 5 central counties, the "out commuters" number about 182,000 of a working force of 1,400,000.

The following data show the comparatively high percentage of workers employed in the same county in which they reside:[8]

County	No. of workers residing in county	Percent working in county	Percent working in contiguous county	Percent working in own or contiguous county
	(thousands)			
San Francisco	346	93.0	3.9	96.9
Oakland (Alameda)	147	69.0	18.7	87.7
Rest of Alameda Co.	208	86.9	4.2	91.1
Contra Costa	144	64.8	14.6	79.4
Three-county total	845	....	....	....
Marin	57	60.9	34.7	95.6
San Mateo	177	56.1	41.1	97.2
Five-county total	1,079	....	....	....
Napa and Sonoma	72	85.8	9.6	95.4
Solano	50	89.5	4.4	93.9
Santa Clara	234	88.7	6.3	95.0
Nine-county total	1,435	....	....	....

The percentages, of course, go up considerably when contiguous counties are added. These data tend to dispel any notion that the Bay Area contains a dominating employment center which is fed by a great metropolitan labor pool.

This is not to say that the commute problem is illusory. The data are quite gross; commuting within counties and between contiguous counties is a matter of great personal importance to workers, and therefore to transportation planners. Perhaps a traffic example will emphasize the point. A recent survey found average traffic on the Nimitz Freeway in Oakland to be 99,000 vehicles per day, of which 22,000 used the bridge to San Francisco.[9] A very large proportion of the remaining 77,000 must have been Alameda County residents traveling to Alameda destinations, including, of course, large numbers of commuters.

Looking at the other side of the coin, we find that almost 27 percent of the San Francisco labor force lives outside San Francisco. Eliminating

[8] Data adapted from material prepared by Donald L. Foley. See California, University, Institute of Governmental Studies, *Housing and the Future of Cities in the San Francisco Bay Area;* by Catherine Bauer Wurster, 1963. (A companion monograph in the current Franklin K. Lane series)

[9] California, Division of Bay Toll Crossings, *Trans-Bay Traffic Study,* November 1962.

the nearby communities of Daly City and South San Francisco, the percentage of commuters in San Francisco's labor force still exceeds 20 percent.

Another point of significance for the future is the apparent growth in "reverse commuting" which some observers believe is likely to increase significantly because of very real housing problems for some segments of the community. It is a matter of interest that over 7 percent of workers residing in San Francisco have jobs in other counties, mostly in contiguous San Mateo County, to be sure. San Mateo workers commute in two directions: north, to San Francisco where one third of its workers go, and south to Santa Clara County where almost 10 percent go. On the other hand, some 12,000 workers come into San Mateo County from the north (San Francisco), while some 16,000 of San Mateo's residents go south and east into Santa Clara County on their daily trips to work.

For the future, consultants to the rapid transit district envision a rather substantial increase in interurban commuting. It was estimated that more than 100,000 daily commuters came into San Francisco to work in 1961, and that 40,000 came into Alameda County. The figure for San Francisco was projected to 133,000 by 1975 and for Alameda to 69,000—increases of 33 percent and 72 percent, respectively.

An estimate of "out-commuters" from the five central counties was prepared, as follows:

County	1960	1975	Percent increase
Alameda	35,700	49,000	37.3
Contra Costa	46,225	73,000	57.9
San Francisco	19,350	22,000	13.7
Three-county total	101,275	144,000	42.2
Marin	19,290	34,000	76.3
San Mateo	61,390	79,000	28.9
Five-county total	181,955	257,000	41.2

The growth in "out-commuting" is expected to be slightly larger than the growth in total population: 41 against 37 percent.

Highway Travel

A primary concern in transportation planning for any area is the future demand for highway space. This depends, of course, on the

volume of highway travel. Highway travel, in turn, is likely to be a function of vehicle ownership. Immediately we should recognize that both highway travel and vehicle ownership will be affected to some extent by the capacity and quality of the highway plant, as well as by other transportation alternatives that may be available.

In the Bay Area, automobile registrations increased about 59 percent between 1950 and 1960 as compared with a population increase of about 37 percent. It seems significant that a consultant to the rapid transit district sees no reversal in the trend. And Stanbery's estimates project a continuation of almost identical growth relationships—a 36 percent population increase in the five central counties by 1975, and a 58 percent in automobile registrations.

It seems reasonable to expect for the Bay Area an automobile population of 3.0 million in 1980 as compared with 1.5 million in 1960. This is based on a probable ownership incidence of one vehicle for two persons. It is more difficult to achieve a confident estimate of the volume of travel that will be produced by these vehicles. Significantly, however, an important fraction of the costs of vehicle ownership is fixed—a large share of depreciation, garaging, insurance, etc.—and thus will have little effect on the decision to travel.

A statewide estimate concludes that vehicle travel will increase at a faster rate than vehicle ownership.[10] While the number of motor vehicles is expected to increase about 2.25 times by 1980 (from 1958), the vehicles miles traveled is expected to triple. Trend figures for total motor vehicle travel in the Bay Area are not available, but there are enough clues to suggest that auto travel per vehicle is increasing and will continue to do so. For example, the number of autos passing through principal interurban gateways in the Bay Area increased 44 percent between 1954 and 1959, while the number of autos registered in the five central counties increased only 22 percent.[11] Other forecasts show larger increases in use of major facilities (bridges, for example) than in vehicle ownership.

Transit Riding

Recent increases in highway usage reflect declines in transit patronage—to the consternation of many students of the urban scene. The Bay

[10] California, Department of Public Works, *The California Freeway System*, September 1958.

[11] The rapid transit district gave considerable attention to passenger flows through major corridors or "gateways" serving interurban movements in the Bay Area. Six gateways were identified, as follows: Transbay, Berkeley Hills, Cerrito Creek, San Leandro, Peninsula, and Golden Gate. The last two will not be served by the district because of the withdrawal of Marin and San Mateo counties.

Area reached a peak in transit riding during World War II, but a precipitous decline followed immediately as cars, tires, and gasoline again became readily available. Looking at the interurban transit figures, one gets a sinking feeling about the future of transit, at least of the kind we have known. For selected years the total number of Bay Area passengers was:[12]

1945	67,300,000
1947	56,700,000
1950	44,600,000
1960	30,000,000

Some observers profess to see a leveling-off in the transit decline. They interpret this as a revulsion against traffic congestion, although there is little evidence that highway congestion is actually growing worse. Thus, a leveling-off might only indicate that we are beginning to touch bottom with a "hard core" of transit captives who cannot afford or are unable to operate automobiles.

One disconcerting fact is that peak-hour transit riding—which is the great hope of transit—appears to have followed the trend of total transit riding, at least until recently. The six principal gateways of the Bay Area showed an increase of 29 percent in total peak-hour person trips between 1954 and 1959, but transit trips declined by 15 percent, a figure almost precisely the same as the decline in annual interurban transit riding for that period.

Projections of future transit riding are especially hazardous because of uncertainty about the kind of system that will be available. It is of interest to note that consultants to the transit district predict both an absolute and a relative decline between 1959 and 1975 in peak-hour transit riding through two principal interurban corridors not to be served by the district. And these two gateways accommodated 57 percent of all peak-hour interurban transit travel in the Bay Area in 1959.

Through the four gateways that *will* be served by the district, its engineers anticipate an increase of about 228 percent in the peak-hour, peak-direction travel in transit by 1975. In each case, the *proportion* of peak-hour passengers expected to be handled by transit is expected to increase substantially.

Total Trip Making

Unfortunately, discussions of urban transport problems have become emotionally charged. Issues are posed as "either-or" propositions. Participants are (or are alleged to be) either "highway-oriented" or "transit-

[12] Ebasco Services, Inc., *Bay Area Rapid Transit Economic Study for the San Francisco Bay Area Rapid Transit District,* June 1961, p. A-13.

oriented." One must be in favor of all proposed freeways or against all. There seems to be a desperate need for dispassionate dissection of the total problem, followed by its reconstruction in terms of an integrated plan encompassing the various needs and purposes, and establishing feasible, complementary operations, and joint use of common facilities.

It is all too easy to lose perspective in piecing together a picture of total transport in an urban complex such as the Bay Area. One must be mindful of the multiple purposes served by roads and streets which are, in any event, essential to community life, regardless of requirements for mobility imposed by peak-hour movements. Even though the freeway *purpose* is limited to the provision of mobility, the value of the freeway lies in its ability to furnish mobility for *many* purposes—the movement of goods as well as people; the movement of people in their social, recreational, business, and other pursuits as well as in the journey to work.

Residents of the Bay Area probably now generate about 7 million person trips per day. In 1975 there will be in the neighborhood of 11 million daily passenger trips. In the three-county area to be served by the rapid transit district there are now about 4 million daily trips. In 1975 the figure should approximate 5.2 million. The district's estimate of rapid transit patronage in 1975 is 258,600 daily trips, of which 157,400 would be diverted from automobiles (roughly 100,000 auto trips). In other words, rapid transit would carry about 5 percent of all daily trips in the three counties, about 2.5 percent in the nine-county area. Virtually all of the remaining trips, 95 percent and more, are expected to be carried in automobiles and buses on highways.

Figures of this kind emphasize the continuing importance of highway transportation to the Bay Area for personal transportation, to say nothing of the internal movement of goods or of highway communications with the "outside world." However, such figures sell short the potential contribution of transit to total transportation—they obscure the magnitude of the peak-hour problem. The truth is that most of the Bay Area's future freeway and bridge problems, and the high cost of their solution, will be occasioned by peak-hour demands.

Transit makes no pretense of carrying any great bulk of total daily movements. The rapid transit system, as conceived for this area, has as its principal objective the supplementation and relief of the freeway system by transporting peak-hour travelers in movements of some distance. A large share of its riders are expected to use highways in order to reach the transit stations.

At the principal gateway served by the district—the Bay Bridge—the district estimates that it may carry 55 percent of all peak-hour, peak-

direction passenger traffic in 1975 (as compared with 40 percent by buses in 1959). At other gateways, transit's share of the peak-hour movement is expected to be less—35 percent through the Berkeley Hills, and less than 25 percent at the other two gateways.

It may be noted here that there is a considerable difference between the actual patronage expected in 1975 and the *possible* capacity of the transit system. For example, the peak-hour, peak-direction patronage is expected to be 16,700 at the transbay gateway in 1975. The comparable figures for the other three gateways are: 5,900, 5,200, and 3,700. All of these numbers are embarrassingly below the "capacity to move 30,000 seated passengers per hour in each direction on each route," which it is asserted the district's schedules could provide at peak hours.[13]

The fact that the fixed facilities of the transit system will apparently have so much unused capacity in 1975 suggests that we should be looking considerably beyond the 1970's in appraising the potential impact of transit on the Bay Area's total transportation requirements. On the other hand, it is noteworthy that the transit district does not expect its system to eliminate the need for freeway building during the 1960's and 1970's. It was assumed, in fact, that 32 additional lanes of freeway in addition to the present 48 would be available to serve the six principal gateways in 1975. Notwithstanding the additional freeway construction, the district engineers foresaw very grave deficiencies in peak-hour highway capacity in 1975 if there were no rapid transit. But even if rapid transit were built along with the additional freeways, the estimates for 1975 show peak-hour highway deficiencies at three of the four gateways served by transit, as well as at the two which will not be served.

Perhaps the transbay crossing can be used to point up expectations. It is assumed that the transit system will be in operation in the late 1960's. The transbay tube will be the most heavily patronized of transit's gateway facilities, carrying more than half of the total anticipated peak-hour patronage of all four gateways. The district expects to absorb about 13 percent of the motor vehicles that would otherwise use the Bay Bridge in the year 1970 (5.8 million of the 44.9 million). This "absorption" would, according to the estimate, relieve the bridge of enough traffic to keep its vehicular utilization in 1970 well below capacity. But it was also estimated that by 1978, notwithstanding the availability of transit, motor vehicle traffic would again have increased sufficiently to bring the Bay Bridge to full capacity.[14]

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[13] San Francisco Bay Area Rapid Transit District, *The Composite Report*, May 1962.

[14] Comment on these and other estimates of bridge capacity and usage is reserved for a later section.

One can only conclude that concerted attention must continue to be given bridge and freeway problems in the Bay Area, not only in the six counties that will not be served by transit, but also in the other three that will. The adequacy of roads and streets will, of course, be a matter of continuing concern—not only do they serve as connectors and feeders to the freeways, but also they will be the life-lines of the transit operation. The transit system itself deserves continuing study in order to enhance its over-all utility to the area. Early consideration should be given to possible extension of transit facilities into other counties, and expansion of services within the three counties now in the district, along with development of appropriate coordinating arrangements with local transit. Individual attention should also be given each of the Bay Area's transportation systems (or subsystems): bridges, freeways, roads and streets, and transit. These major facilities, existing and proposed, are shown in the map on the frontispiece.

The Bay Crossings

The Bay Area's greatest natural asset—the Bay itself—presents some formidable transportation challenges. Seven highway bridges, two of them world masterworks, span the Bay at various points. There are no rail transit crossings at present, and the railroad bridges at the extremities of the Bay do not provide local passenger service. The highway bridges, existing and proposed, are shown in the frontispiece map.[15]

The highway bridges may be looked upon as three systems. No problems are foreseen, at least until 1980, in the system serving the northeastern portion of the area, which includes the recently augmented Carquinez Bridge, where a parallel structure has been added, and the newly built Benicia-Martinez crossing.

Consideration of New Crossings

The other two systems consist of three bridges in the South Bay and two in the North Bay. Together the five structures accommodated about 71 million vehicular crossings in 1961, a week-day average of 240,000. About 57 percent of the traffic crossed the San Francisco-Oakland Bridge, about 29 percent crossed the Golden Gate.

A recent survey compares present traffic and estimated capacity of the five bridges, as follows:[16]

	Annual capacity (thousands of vehicles)	1961 use (thousands of vehicles)
South Bay:		
San Francisco-Oakland[a]	45,000	40,286
San Mateo[a]	18,000	3,825
Dumbarton	5,000	2,683
North Bay:		
Golden Gate	25,000	20,702
San Rafael-Richmond	25,000	3,606

[a] After reconstruction is complete.

[15] From time to time over many years consideration has been given to the construction of barriers in the Bay which would serve highway and rail facilities, and provide fresh water lakes as well. The proposals have always been rejected as infeasible by those in position to do something about them. However, a report of the U. S. Corps of Engineers is expected shortly which may reopen the question.

[16] Coverdale and Colpitts, *Report on Traffic on the Existing San Francisco Bay Crossings and the Proposed Potrero Point-Alameda Crossing, Sierra Point-Roberts Landing Crossing, San Francisco-Marin Crossing,* San Francisco, September 15, 1962.

The survey estimated that the San Francisco-Oakland Bridge would reach its capacity by 1965 and the Golden Gate Bridge by about 1967. In this paper the engineers' estimates are used at face value. Many questions might be raised, one of the most crucial being the question of capacity. Coverdale and Colpitts derived annual capacity from assumptions about the per-hour capacity of each lane, and the percentage of total daily traffic represented by peak-hour traffic. For example, Bay Bridge capacity is assumed to be 1,500 vehicles per lane per hour, or 7,500 vehicles in the peak direction, a flow that the bridge is nearly carrying at present, before completion of reconstruction. If future capacity were as much as 1,700 vehicles per lane per hour, the annual capacity of the bridge would be 51 million instead of 45 million. A greater spread of traffic over the course of the day, or longer peak periods, would also increase the daily and annual capacity estimates. The Division of San Francisco Bay Toll Crossings recognizes the "subjective" nature of capacity estimates by saying: "There are a number of considerations which complicate the estimation of the practical capacity of an urban highway facility. . . . First, determining what is 'unreasonable' delay, hazard, or restriction of movement is essentially a subjective judgment."[17]

Notwithstanding the fact that "capacity" is a matter of judgment, within some significant range, consideration has been given to the early construction of two additional bay bridges. Estimates of annual traffic flows in 1980 have been made under a number of assumptions:[18]

1. That no new bridges would be built before 1980.
2. That *either* a Sierra Point-Roberts Landing crossing *or* a Potrero Point-Alameda crossing would be built by 1970 to serve South Bay traffic.
3. That a new San Francisco-Marin crossing would be built by the end of 1970.

Projected results of these alternatives, in various combinations, are shown in the table, p. 23.

Increases in vehicular traffic are expected for two reasons: (1) general growth of the area, and (2) generation of new traffic as capacity is added to the crossing systems. As to over-all traffic increases, it was estimated that growth would be significantly restrained by lack of capacity if no new bridges were built. In 1980, for example, traffic across the South Bay would be 54 percent higher than in 1961 with the Alameda crossing, but only 26 percent higher with no new bridge. Across the North Bay to Marin, traffic would be 76 percent higher with the new bridge, but only 32 percent higher without an additional crossing.

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[17] California, Division of San Francisco Bay Toll Crossings, *op. cit.*, p. 75–77.

[18] Coverdale and Colpitts, *op. cit.*

Notwithstanding lack of capacity on preferred crossings, vehicles in excess of assumed capacity would continue to cross the Bay on alternate crossings, according to the estimates. Without new bridges, for example, it is estimated that 4.2 million vehicles in 1970 and 8.0 million vehicles in 1980 would be diverted from the Bay Bridge to the San Mateo Bridge. Diversions from the Golden Gate Bridge to the San Rafael-Richmond Bridge are estimated to be 1.2 million in 1970 and 3.2 million in 1980. It is of interest that even with the new Alameda crossing in the South Bay, almost 1.3 million vehicles in 1975 and 6.1 million in 1980 would be diverted from the preferred Bay Bridge to the new bridge. It is obvious that all of these diversions could occur only at some cost to the users—in time, distance, or both—otherwise the assumed preference would be irrational.

Perhaps even more interesting is "the case of the disappearing cars." It is commonly assumed that failure to construct new bridges will not stunt the over-all growth of the area in terms of population, employment, and economic activity generally. But the estimates tell us that approximately 47,500 vehicles per day (roughly 80,000 persons) that would have crossed the Bay in one direction with new bridges would not do so without them, representing about 37,000 people in the North Bay and about 44,000 in the South Bay. It seems reasonable to assume that the great majority of these would be commuters, since it is the capacity restraint at peak-hours that causes the reduction in traffic.

The engineering reports are silent about the consequences. Will these people decide that trips across the Bay are unnecessary and give them up? Will they make trips to other destinations instead? Will there be an increase in riding in car pools or in mass and rapid transit? Will people change jobs to be nearer their residences, or change residences to be nearer jobs? Or, in either case, will they avoid the Bay crossing? In short, what will be the total responses to the alternative situations in terms of transportation usage and land use patterns, including the

	1980 vehicle crossings in thousands		
	South Bay	North Bay	Total
Existing bridges only	68,411	37,961	106,372
Existing bridges plus Roberts Landing	76,175	37,961	114,136
Existing bridges plus Alameda	83,566	37,961	121,527
Existing bridges plus Marin	68,411	50,545	118,956
Existing bridges plus Marin and Roberts Landing	76,175	50,545	126,715
Existing bridges plus Marin and Alameda	83,566	50,545	134,111

crucial relationship between residential and job locations? These are the kinds of questions that need to be dealt with forthrightly if we are to have truly comprehensive transportation planning suitably integrated with general planning for the metropolitan region.

The Coverdale and Colpitts report "made no allowance . . . for the effect that the construction of a regional rapid transit system may have on transbay vehicular traffic"—although the publication date was less than two months before the transit bond election. Transit district engineers, however, made an estimate of transit's impact on the existing Bay Bridge, in order to predict future toll revenues.[19]

It was estimated that by 1970, 44.9 million vehicles would cross the San Francisco-Oakland Bay Bridge if there were no rapid transit. Rapid transit would "absorb" about 5.8 million vehicles, thus reducing traffic to about 39.1 million, well under the annual capacity of 45 million (which the district consultants also accepted). Vehicular traffic would then begin to rise, until by 1978 it would have again reached the capacity of the bridge. The implication is that the need for a new crossing would be delayed until about 1978 owing to the transit operations, as compared to the date of 1970 (or earlier) that is suggested by the bridge engineers.

As a first observation, it appears that the bridge engineers, notwithstanding their assumed restraints on traffic growth because of capacity limitations, estimate heavier vehicular traffic for the bridge than does the district. For example, in 1970 the bridge engineers estimate traffic attempting to use the Bay Bridge at 49.2 million, of which 4.2 million are reassigned to the San Mateo crossing. If we were to deduct the district's figure of 5.8 million to be absorbed by transit in 1970, there would be about 43.4 million vehicles on the bridge, not much below its estimated capacity of 45 million. To look at this another way, we might say that the traffic which had to be "reassigned" to the San Mateo Bridge would be immediately "returned" to the Bay Bridge when capacity was made available because of transit operations. Also, using the bridge engineers' reasoning, it would seem that the greater growth of cross-Bay vehicular traffic which would occur when capacity was added to the crossings might take place whether capacity was increased by new bridge construction or by absorption of traffic by transit. On the other hand, it might be observed that if, as is expected, transit makes its greatest impact through absorption of peak-hour traffic, it could change the percentage relationships from which daily

[19] San Francisco Bay Area Rapid Transit District, *The Composite Report,* May 1962. (The North Bay crossings will not be affected directly by transit as the district is now constituted.)

and annual bridge capacities are calculated—this is to say, a lower percentage of peak-hour to daily traffic would mean a higher annual capacity. This would, in turn, change the estimated time of need for a new crossing.

This paper will not attempt a reconciliation of the various estimates. Enough has been said to show that the bridge problems are still with us, and are not likely to disappear soon, regardless of other transport developments in the Bay Area.

Specific Bridge Problems

Location.—Questions regarding the location of possible new bridges in the Bay Area have provoked much controversy for many years, especially with regard to the South Bay crossings.[20] Certain complications are added by the presence of military establishments as well as by the need to satisfy navigation requirements determined by the U. S. Corps of Engineers. But the issues run even deeper.

On the one hand, there is a strong desire to relieve present congestion and to serve existing traffic flows, accompanied by a tendency to estimate future traffic by extrapolation from recent and current patterns. Such reasoning leads to the conclusion that the closer a new crossing is located to an existing bridge the better it will serve traffic, not only now but in the future. For example, a new parallel structure of equal capacity to an existing structure would carry or "divert" almost exactly 50 percent of existing traffic—no other structure could do so well. Thus, the specific location of a parallel crossing would tend to fulfill the prophecies made for it.

Actually, serious consideration was given to the construction of a bridge parallel to the existing San Francisco-Oakland Bridge in the late 1940's. The idea of a parallel crossing was rather short-lived, but controversy continued to rage over the location of any crossing farther to the south. After almost twenty years of study and discussion there is still no decision on the location of a new South Bay bridge. Fortunately, the reconstruction of the existing Bay Bridge after removal of tracks, the reconstruction of the San Mateo Bridge, and the possibilities of traffic relief by the new rapid transit system, have conspired to re-

[20] Preliminary studies for a second crossing to Marin County via the Tiburon peninsula stirred so much controversy that they have been discontinued for the time being. The main issues here seem to involve possible impacts on properties at the bridge approaches, and are more akin to freeway location problems than to the issues involved in location of the South Bay crossing. However, it is also to be noted that the planning commissions of San Francisco and Marin counties "desired that a survey of the transportation needs of the Bay Area on a regional basis be made' before any further action was taken. (California, Division of San Francisco Bay Toll Crossings, *Trans-Bay Traffic Study*, November 1962, p. 7)

move pressures for an immediate location decision. It might also be hypothesized that the failure to locate and construct a new bridge has had an influence on residential and job locations, with results quite different than would have occurred with a crossing in place.[21] None of this, however, disposes of the question of need for an additional South Bay crossing in the future.

The most recent bridge studies compare alternative locations for a southern crossing. The analytical approach seems remarkably similar to that noted above, which concentrates heavily on existing traffic and its extrapolation into the future. For example, the estimates indicate that an Alameda crossing, if in place, would divert 18.8 percent of *1961 traffic* from the existing Bay Bridge, while the crossing farther to the South would divert only 4.4 percent. The former would reduce Bay Bridge traffic to 4 million less than capacity if in operation in 1971, but the latter would require a "reassignment" of some 3 million vehicles from the existing bridge in 1971 in order to reduce its traffic to estimated capacity. Moreover, the former would bring about some 7.4 million more transbay vehicle crossings in 1980 than would the more southerly bridge.

At the heart of the location controversy lies the question of impact of the various alternatives on future land development. This issue, of course, permeates all transportation decisions but perhaps nowhere is it so dramatically pointed up as in the case of permanent major structures, such as the Bay crossings. Certainly, real estate interests in the area comprehend their significance, whether by intuition or otherwise, for it is obvious that conflicts among property interests fan the fires of controversy over alternate locations.

It seems almost fair to say that property interests have been considerably more perceptive than have the engineers and planners who are studying the problem. But it should also be pointed out that our technical capabilities for dealing with land use responses to transport alternatives in a systematic and meaningful way are not adequate. The highly deterministic approaches involved in traffic analysis and projection would seem to require modification if the over-all goals and aspirations of the metropolitan region are to be served. If nothing better, all sides of the issue should be exposed to public discussion and deliberation, supported by such formal analyses and evaluations as can be marshalled to achieve an informed consensus which will advance the future welfare of the entire metropolitan region.

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[21] There is also evidence that commuters and others can and do adjust to congestion by spreading travel over longer peak periods; thus, in effect, increasing the daily (and annual) capacity of a crossing above that estimated from peak-hour movements.

Financing.—It is generally assumed that any new crossing of the Bay will be financed by tolls. It also appears to be assumed that tolls will remain on existing bridges even after they have been paid for. Finally, it is widely accepted that there would be a pooling of tolls—at least with respect to each of the three separate systems—so that existing bridges would support the new ones. Under these circumstances, financing problems have not been thought to loom large. However, two questions deserve mention.

The fact that the Golden Gate Bridge is under the jurisdiction of the Golden Gate Bridge and Highway District may pose something of a problem. If there is to be a pooling of toll revenues for the North Bay crossings, a special arrangement will have to be made. Either the district itself might assume the financing, construction, and management of a new crossing, or the state might acquire the existing bridge from the district and operate it as part of the North Bay system. The third alternative of a new state bridge with tolls and a district bridge without seems highly infeasible.

A new South Bay crossing is likely to pose financing problems of another kind. In the arrangements for financing the rapid transit system it was provided that the transbay tube and its approaches be built and financed by the state. Revenue bonds supported by bridge tolls are to provide the funds.

An illustrative financing plan for the tube has been suggested.[22] Costs of the tube and approaches are estimated at about $135 million, to which would be added about $66 million in interest, thus establishing a total claim on bridge revenues to 1987 amounting to $201 million. Toll revenues to 1987 might be about $300 million, thus leaving a "cushion" of about $99 million by 1987 after financing the tube and meeting other obligations and expenses. To this could be added about $61 million which, according to one tentative schedule, would be paid back by the district to the state in annual installments of $3.4 million over 18 years from 1969 to 1987. Even so, the net cost to the Toll Authority of some $140 million to be defrayed from bridge tolls is bound to pose some problems in the financing of any new crossing, especially if construction is found to be desirable sometime during the 1970's.

[22] San Francisco Bay Area Rapid Transit District, *The Composite Report,* May 1962.

The Bay Area Freeway System

California is widely known for its developing freeway system—especially the urban sections. California adopted the freeway principle in 1939, and its highway program was greatly accelerated in 1947, following statewide studies of needs during and immediately after World War II. The 1947 action gave the state government complete responsibility for state highways within cities. It was also understood that most of these highways would be developed to freeway standards in the larger cities and metropolitan areas.

The principle of the freeway—the limitation of access and the elimination of cross traffic at grade—makes possible a facility of remarkable convenience, economy, and safety for the movement of motor vehicles. On all scores more efficient than the conventional arterial, road, or street, the freeway consumes *less* land for economical movement of comparable volumes of traffic. The freeway's great advantage is that it separates the road from the environment and the environment from the road, with benefit to both. It might be said, however, that the separation, for the visual, auditory, and even olfactory senses, is not always as thorough as one would like—and this, too, can be true for both road and environment!

California's freeway program was accelerated in 1953 by increases in state taxes, was stepped up again by the federal highway program of 1956, and was formalized in 1959 by legislative adoption of the California Freeway System consisting of some 12,500 miles of state highways.[23] The last action was taken after a two-year engineering study with the advice of a citizens' committee and with the full cooperation of local governments.

The portion of the state freeway system in the San Francisco Bay Area is shown in the frontispiece map. It consists of about 1,350 miles of state highways, of which about 240 miles of local roads and streets were added by the Legislature in 1959, after the engineering study and with the strong support of local governments in the area. Actually, of the 1,350 miles in the system, only about one fourth had been completed and placed in operation by mid-1962, which is, of course, an important reason why the existing facilities are often congested.

Freeway Service

Highway engineers have estimated that the proposed freeway system for the Bay Area when "completed" in 1980 will carry about 60 percent

[23] California, Department of Public Works, *The California Freeway System,* September 1958.

of all motor vehicle traffic in the area but will constitute well under 10 percent of the road mileage. The same source estimates a total of 195 billion vehicle miles of travel in California in 1980, of which we may guess that 45 billion miles will be traveled in the Bay Area.[24]

If these estimates hold, about 26 billion vehicle miles of travel would be performed on Bay Area freeways, which might represent about 40 billion passenger miles of travel. By way of rough comparison, a liberal projection of the transit district's patronage expectations yields an annual figure of about one billion passenger miles in 1980. Rapid transit, however, will be provided primarily to serve the peak period commuter movement to and from central areas. The freeway system is designed to provide this service over a far wider territory, and it will handle the great majority of travel for all other purposes, aside from purely local trips. The state, in providing copious freeway service, has progressed far beyond its original role of serving only the needs of "statewide" travel. For the time being, it has become the dominant authority in Bay Area transportation, although the long-range objectives of state policy for the expansion of freeway service have never been clearly defined.

In California, as in other states, the original purpose of the state highway system was to connect county seats and other population centers, in order to provide high-grade *intercity* roads for motor vehicles. It was the general practice to stop state highway construction at city boundaries. Gradually the state became involved with taking intercity traffic through, around, and finally into cities—first the smaller ones, then the larger—but always trying to limit its involvement to a theoretical responsibility for "state" traffic.

For various reasons, this limitation could not survive. Providing for through traffic on urban extensions of intercity routes was scarcely feasible without furnishing an adequate facility for all traffic, including commute and other local movements. In addition, the growing congestion of traffic in cities was forcing consideration of urban highway construction on a scale well beyond the fiscal capacities of local governments. The state maintained the large highway operating agency needed to construct freeway-type roads, and it possessed exclusive control of the taxation of highway users.

By the time California's large postwar freeway building program had been launched, the state had acquired full financial and managerial responsibility for state highways in cities. Even then, the state's participation might have been confined only to those routes which it considered natural extensions of the statewide road system. But continual

[24] *Ibid.*

additions to the state system in California's urbanized areas eventually gave the state responsibility for highway networks blanketing the metropolitan regions.

It will be of interest to trace briefly the evolution of the state's position in the Bay Area, for this will give some perspective on the ultimate course of freeway developments. In the first stage of the urban freeway program, the major and familiar state highway routes were converted into freeways: U. S. 101, running north and south, became the Bayshore and the Redwood freeways; U. S. 40 to the north and east became the Eastshore Freeway; State Route 17 from Oakland to San Jose became the Nimitz Freeway; and U. S. 50 connects with the Nimitz and extends east over the Altamont Pass as a freeway.

At the present time, these routes are virtually completed. In 1957, their completion could be foreseen within the immediate future, and the state was then planning the next, and more difficult, stage of freeway building. The district engineer for the state highway division at that time commented:

> The story of the coming decade will be quite different. . . . From the outset the system has been based on the knowledge that but one freeway extending in each of the several directions from the central metropolitan cores would not be sufficient to handle the potentials of this great area. It has been realized that other freeways offering similar directional movement but providing traffic service to and through many local areas of congestion somewhat removed from initial freeway developments will be required in the future.[25]

The freeways now being constructed in the Bay Area are mostly of this class; they serve new territories within the metropolitan area, while diverting some of the traffic from the main intercity extensions already built. The routes include the MacArthur Freeway in Oakland, the Southern Freeway in San Francisco, the Junipero Serra on the Peninsula, the Grove-Shafter in Oakland, Mt. Diablo and Arnold Industrial freeways in Contra Costa County, the outer belt Interstate highway connecting with the Benicia Bridge, and a number of shorter routes serving as connectors.

When completed, these highways will offer little service to traffic moving through the Bay Area to and from other regions that is not now available on the main intercity extensions. Their primary purpose is to link up the major sub-areas within the area, but they will also serve as "distributor" routes for long-distance intercity traffic. When completed, probably about 1970, the Bay Area will have a full regional network of freeways, except at its outer extremities.

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[25] B. W. Booker, "Freeways in District IV," *California Highways and Public Works* 1–20, March–April 1957.

What then of the freeway program? Freeway building can hardly be expected to cease, for expansion in road capacity will be necessary to keep the existing network operating efficiently. When the outlines of the regional system are filled in, additional routes may be built to avoid traffic congestion on the freeways and on surface streets.

It seems evident that progress into this stage of the freeway program will be extremely costly and controversial. Some of the routes, such as the Ashby Freeway in Berkeley and the much-disputed Western Freeway in San Francisco, would run through built-up areas in order to attract short-distance trips using clogged surface streets. Preliminary estimates indicate that the costs of these facilities would be high if they are to be made "acceptable" to the communities through which they pass. Even so, there is some doubt about their eventual approval. Other freeways, intended mainly to relieve congestion on the existing regional system, would have to use rights-of-way of enormous expense. For example, the two "sea-going" freeways on either side of the Bay—the "shoreline" in the East Bay and the Bay Front in the West Bay—would be constructed mostly on fills in the water to avoid formidable location problems on the land.

The economic justification for investment in these congestion-relieving supplements will become progressively less apparent. The need for them will be dictated largely by the intensity of peak-hour demands, and they should be evaluated accordingly. A large expenditure will be required for traffic service over relatively short time periods, and for the benefit of relatively smaller numbers of vehicles. Since this is the type of service for which public transportation is designed, it is precisely here that serious consideration should be given to alternative means of dealing with peak-hour demands.

Moreover, there is no foreseeable termination date for this type of freeway development, except as might be brought about by an end to regional growth or a trend away from motor vehicle use. Much of the freeway route mileage now in the early planning stages, and scheduled for construction in the 1970's, was added to the state highway system *after* the start of the freeway program in 1947. Indeed, most of it was added in 1959 when the statewide freeways plan was adopted. The system, it is true, was planned with regard to traffic needs in the year 1980, but this date appears to have no real significance except as a cut-off point for the extension of forecasts. If Bay Area traffic is to be provided adequate freeway services *ad infinitum,* an end to freeway development is not yet in sight.

It would appear that the state is becoming progressively more involved in an activity where the regional interest in traffic service is

plainly paramount over state and federal interests. Thus, the prospectus for a major comprehensive Bay Area Transportation Study, with strong local participation, presents a sound and timely proposal. For the transportation development—including freeway construction—that will occur in the 1970's and beyond will be significantly influenced by careful study and planning done over the next few years.

Freeway Opposition

Two occurrences have led some observers to conclude that the Bay Area may have already rejected freeways in its transportation planning for the future. First, in January 1959, in a so-called "freeway revolt," the Board of Supervisors of the City and County of San Francisco took exception by official resolution to the location and design of certain freeways within the city. As a result of this action, the state has suspended studies and planning for these particular freeways, which constitute only a few miles of the total system mileage of the Bay Area—although they are extremely *important* miles.

In connection with the "revolt," it may be said that other freeways are now abuilding in San Francisco. The San Francisco Chamber of Commerce and the Downtown Businessmen's Association have consistently urged completion of the rejected facilities. The disputed freeways were, in fact, already in San Francisco's own trafficways plan. Moreover, the city's departments of public works and planning, in a joint effort, have reappraised the earlier freeway proposals and have urged that they be carried through with some modification as to design but little as to location, notwithstanding the fact that the rapid transit system will be in operation.[20]

Knowledgeable people in the Bay Area recognize that the current difficulties lie mainly in location and design problems, and do not stem from outright rejection of freeways and automotive transport. But they know also that San Francisco itself, densely populated and confined to a small area with nowhere to grow but up, presents a hard case. In such an area, the displacements of businesses and residents by freeway rights-of-way are considerable. The inconvenience of relocation is rarely fully compensated. Then, too, the necessary relocations are likely to entail movement beyond the city boundaries, thus depleting the tax

[20] In appraising the remaining "network" of freeways still authorized after the "revolt," the departments said: "It is concluded that with Network 60 and no rapid transit, about eleven times as much congestion would exist in 1975 as now exists. With rapid transit, there would be about nine times as much. As congestion becomes more serious it becomes not just a peak-hour problem but affects almost everyone at almost any time of day." (San Francisco, Departments of City Planning and Public Works, *Trafficways in San Francisco—A Reappraisal,* November 1960, p. 30.)

base, among other consequences. It is significant that other counties and cities, with their lesser densities and greater areas, are avidly seeking freeway development as a general rule, notwithstanding contro versies over locations and design in specific situations.

The second circumstance possibly giving rise to a wrong impression about freeways in the Bay Area is the recent voter approval of the rapid transit district's $792 million bond issue. There can be little doubt that some unknown fraction of the voters regarded their ballots for transit as votes against freeways. But if they were thinking about freeway construction contemplated for the next fifteen to twenty years, they are likely to be in for a rather rude awakening.

There should, however, be no occasion for real surprise. Engineers of the Rapid Transit Commission, commented as follows on proposed train speeds and station spacings:

> The system proposed for the Bay Area is more comparable to a commuting railroad than to existing rapid transit systems. On the other hand, unlike most commuting railroads, it would have a frequent interval of service in off-peak hours. The Bay Area system is therefore unique. *It is intended to operate as a complement to a system of freeways, expressways, and arterial highways in an area where automobile ownership per capita is very high.* [Emphasis supplied.][27]

It was noted above that the rapid transit district projected the completion of 32 more lanes of freeways through principal gateways, making a total of 80 in all. Even so, peak-hour, peak-direction highway deficiencies were anticipated at five of six gateways with the three-county rapid transit system. It was also noted above that the "2020 Report" contemplated an extensive system of freeways, in addition to the rapid transit system. Finally, the engineering report on bay crossings assumed that thirteen additional freeways would be built to serve the crossings by the time new bridges might be completed in 1970.

Freeway Location

For fiscal and other reasons, it is unlikely that any freeways except those in the state highway system will be built in the Bay Area, unless there are some far-reaching shifts in responsibilities. Currently, the State Highway Commission is, for all practical purposes, the "metropolitan freeway authority" for the Bay Area. The adoption of freeway routings for state highways is the responsibility of the commission, acting upon recommendations of the State Highway Engineer. Hearing procedures have been set up, but these often engender great heat, since

[27] Parsons, Brinckerhoff, Hall and MacDonald, *Regional Rapid Transit, 1953–1955*, 1956, p. 69.

the public participants usually consist mainly of property owners directly affected by the proposed location—and often about to be displaced. To the casual observer, it frequently appears that any specific freeway proposal has no friends; yet the commission supports the highway engineers in the vast majority of cases, recognizing that they presumably reflect the interests of the traveling public, who tend to back freeways in principle but shy away from advocating specific locations.

It should be noted that local governments have a final word on freeway locations. Under state law, no road and street may be closed until an agreement has been made with local authorities, and it is a rare case indeed which does not involve road and street closings. State and federal law also require consideration by the commission of "community values" and "economic effects" in deciding upon freeway routings. Unfortunately, the terms are difficult to define and are subject to debate when nonmarket considerations such as social costs and gains are involved.

A survey made a few years ago suggested that the most meaningful way in which these terms could be given substance was through the official development and adoption of comprehensive local plans.[23] No instances of freeway location were found in which the highway commission had violated the substance of local plans. But, at the same time, it was recognized that many local units possessed no effective plans, while others denied their own plans in controversial cases. Most significant was the absence of locally sanctioned plans for the entire metropolitan area. More frequently than not, conflicting interests of different political jurisdictions were involved. Somehow these must be reconciled for the over-all good of the community.

Freeway Costs and Financing

The estimated costs from 1961 to 1980 of building the Bay Area portion of the California freeway system is $2.3 billion, while another $400 million would be required for other state highways (some of which will also be built as freeways). Freeway mileages and estimated costs by counties in the Bay Area are shown in the table on page 35.

The mileage shown in the table includes the 240 miles added to the state highway system and included in the California freeway system by the Legislature in 1959. Provision was made for a review of the freeway system's composition, costs, and financing every four years.

California state highways are financed on a pay-as-you-go basis from

[23] California, University, Institute of Transportation and Traffic Engineering, *Freeway Location Conflicts in California;* by Richard M. Zettel and Paul W. Shuldinger (Research Report no. 29), Berkeley, January 1959.

continuing appropriations of proceeds of uniform statewide highway-user taxes—mainly gasoline taxes and motor vehicle fees—and apportionments of federal aid, which are also furnished by dedicated highway-user revenues. The amount available for state highway construction is that remaining after financing state motor vehicle functions and the highway patrol, making apportionments to counties and cities for roads and streets, and providing for administration, planning, and maintenance of the state highway plant.

It is estimated that continuation of present levels of financing would permit the "completion" of the California freeway system by 1980. But it should be noted immediately that much of the mileage would not be built until the late 1970's, although it would be needed much earlier for the safety, convenience, and economy of traffic. It may also be noted that any "diversion" of state highway-user funds to roads and streets or to transit would slow the pace of freeway building.

County	Freeway mileage	Freeway costs	Freeway costs, plus other state highway costs
Alameda	227.0	$597,521,000	$612,290,000
Contra Costa	183.4	275,338,000	275,588,000
San Francisco	46.3	126,849,000	435,795,000[a]
Three-county total	456.7	$999,708,000	$1,323,673,000
Marin	121.7	117,616,000	121,513,000
San Mateo	182.7	609,708,000	629,954,000
Five-county total	761.1	$1,727,032,000	$2,075,140,000
Napa	92.9	65,352,000	68,914,000
Santa Clara	193.2	279,761,000	319,003,000
Solano	134.8	93,645,000	96,865,000
Sonoma	163.5	117,653,000	144,514,000
Nine-county total	1,345.5	$2,283,443,000	$2,704,436,000

[a] In San Francisco certain highways are not included in the California freeway system but remain in the national system of interstate and defense highways—if built at all, however, they will be constructed to full freeway standards.

Although the highway commission is charged with preparation of the state highway budget, its powers are circumscribed by a number of legislative formulas. The most important of these are an annual division of construction funds between Northern and Southern California, and minimum construction guarantees in each of several geographic areas—corresponding to highway districts—during each four-year period. The division between North and South, now 45 percent to the

North and 55 percent to the South, is the result of a legislative compromise between two conflicting notions of distributive equity; namely, distribution in proportion to estimated highway needs and distribution in proportion to highway-user revenues generated. Needs estimates favor the North; revenue generation favors the South. The minimum construction guarantees for highway districts are derived from state highway needs estimates and are to be revised periodically, the underlying thought being to provide a uniform rate of improvement of highways throughout the state. Notwithstanding political realities, the guiding concept of financing has been the development of a statewide system of main highways supported by a statewide pool of user revenues. This point is often ignored when individual counties and cities begin to make assertions about "our money" which they would like to use as they see fit.

It is only fair to add, however, that the scheme of financing highways is a little too neat, a little too convenient.[29] It is all too easy to assert economic justification for highway system improvements on grounds that effective demand is proved by the fact that the entire network is self-sustaining. Once having assumed effective demand for highway travel, it is comforting to know that the freeway provides greater safety and convenience at less cost than other highway facilities, and is protected against obsolescence by limitation of access. To illustrate, the building of freeways and other state highways in the Bay Area is expected to cost about 20 percent less to 1980 than the costs of providing adequate roads and streets, but the former will carry about half again as much traffic as the latter.

The danger in gross analysis of this kind is that it oversimplifies the economic issues involved. It confuses fiscal feasibility—the availability of funds—with economic justification for specific projects and system improvements. It ignores the possibility of massive cross-subsidies—from one geographical area to another, from low cost to high cost freeways, from roads and streets to freeways, from off-peak uses to peak period uses, all of which may derive from the fundamental uniformity of the statewide user tax base.

The fiscal scheme successfully developed as the means of financing intercity and rural roads has been imported bodily into the urban scene where its full consequences have not been given adequate attention. Individual facilities are justified, not on grounds that they pay for

[29] California, University, Institute of Transportation and Traffic Engineering, *Economic Considerations in the Geographic Distribution of Highway User Tax Revenues;* by Richard R. Carll and Tillo E. Kuhn (Research Report, no. 33) Berkeley, June 1962.

themselves, but on the grounds that benefits—preponderantly non-marketable time-saving to commuters, for example—outweigh the market costs of the improvement. Little attention is given to social costs. The convenience of user financing favors highway solutions to urban transport problems. Statewide collection and dedication of user taxes breeds a statewide uniformity of approach to transport problems. Capital for highway improvements takes on the nature of "free" foreign aid which any community would be loathe to forego.

These comments on finance suggest the need for improved evaluation of investment in freeway projects in the future. The problems grow more difficult as the system expands. The movement from one stage of freeway investment to another will perhaps never be clear-cut, but there are subtle shifts in emphasis and objectives to which attention should be given. These may be inadvertently overlooked because the continuity in freeway financing tends to obscure the issues involved. The urban freeway program in a metropolitan area, such as the Bay Area, ought not be regarded as an "all or nothing" proposition forevermore. There is need for better analytical techniques to give a broader base of understanding of the economic and social impacts of the developing freeway program.

Bay Area Roads and Streets

Road and street systems are virtually taken for granted in the contemplation of total transportation problems of a metropolitan area. They are prosaic, and they inspire comparatively little controversy either in location or design. Yet the road and street systems might be regarded as the basic webbing upon which all else is built.

Roads and streets are multiple-purpose facilities. They provide easements for light and air. They provide corridors for utility services—water, electricity, gas, sewerage lines. They provide the access to properties without which the properties would have little or no value. The most important road, it has been said, is the road past your door.

Roads and streets start as extensions of private driveways, become collectors of traffic, grow into arterials serving an ever-widening community, and finally connect with an areawide, a regionwide, a statewide, and, ultimately, a nationwide network, much of which will become freeways upon which one never has an origin or a destination.

In the contemporary urban scene, roads and streets are expected to be as essential to rail rapid transit as they are to freeways. Through the major corridors of travel, they become a part of "the system," providing extra capacity, especially useful in peak hours, in addition to that furnished by the more exciting and controversial engineering works of transportation.

There are about 14,000 miles of roads and streets in the Bay Area, about 6,700 miles being under county jurisdiction, about 7,300 miles under city jurisdiction. This mileage will grow as population expands, and as new housing and economic activity are established in the area.

In California, the responsibility for administering roads and streets, including their construction and maintenance, remains with the cities and counties. As we have seen, the responsibility for the state highway system is lodged solely with the state, and for all practical purposes a state agency has become the metropolitan area's freeway authority.

Notwithstanding this division of labor, the state participates in the financing of roads and streets through shared revenues and grants-in-aid, most of which are made available from statewide highway-user charges. In 1961–62, for example, the total receipts for roads and streets of the nine counties and all cities in the Bay Area amounted to $109 million, of which $27 million was derived from state sources. The receipts figure, however, includes a large bond program for Santa Clara County, which distorts the picture for the particular year in question. Removal of the Santa Clara totals gives us a more "normal" picture of

the division of fiscal responsibility for roads and streets. In 1961–62, the state provided about 45 percent of the receipts for road and street purposes in eight counties of the Bay Area (including their cities).

There is, however, another large source of funds for roads and streets which does not show at all in the governmental accounts. For example, in 1961–62, almost $25 million was made available for roads and streets in new housing subdivisions of the Bay Area, of which more than $20 million was expended directly by subdividers and about $5 million was provided through special assessment proceedings. It is significant that well over 40 percent of the subdivision road improvement took place in Santa Clara County, the area's most rapidly growing section.

Road and Street Deficiencies and Needs

In 1960, the State Department of Public Works prepared an estimate of existing and future needs for improvement of county roads and city streets in California.[30] This survey, made in collaboration with cities and counties and with the assistance of an advisory committee, estimated deficiencies to 1980 in terms of pre-specified engineering standards. The results were reviewed by the department to achieve uniformity and practicality.

The Bay Area estimates for the 1960 to 1980 period, according to classes of roads and streets, were:

	Counties	Cities	Totals
	thousands	*thousands*	*thousands*
Primary roads and major arterials..	$427,172	$533,967	$961,139
Collector roads and streets.....	174,091	186,933	381,024
Subtotal.....	$621,263	$720,900	$1,342,163
Local roads and streets—existing...	108,958	100,820	209,778
Local roads and streets—future....	1,281,933	587,054	1,868,928
Total.....	$2,012,154	$1,408,774	$3,420,928

It has been emphasized that the needs estimates are predicated on completion of the freeway and expressway system as now projected for the area. Without the freeways, road and street congestion would be much greater, and the cost of improving them to handle traffic loads would be much higher. It was suggested also that transit development would

[30] California, Department of Public Works, *California County Road and City Street Deficiencies,* August 1960.

not change road and street needs materially, but might shift locations somewhat.

Perhaps one of the more striking findings of the survey for the Bay Area was the great need estimated for roads and streets not now in existence—in excess of $1.8 billion of a $3.4 billion grand total. Fortunately, it may be anticipated that these large expenditures will be financed through private development.

The financing of improvements on existing road and street systems is quite another matter. A continuation of present trends would meet only about one half of county road and street "needs" of the Bay Area. The area could undoubtedly continue to function if many of the so-called "needs" should remain unmet—but the consensus appears to support accelerated rates of road and street financing. A program to accomplish this was enacted by the state Legislature in 1963.[31]

1963 Legislation

The program embodied in Senate Bill no. 344, which has been four years in the making, will increase various state highway-user taxes enough to yield about $70 million a year more, of which about $15 million will be allocated by formula to counties and cities in the Bay Area. This will be added to the $35 million or so that counties and cities now receive annually from the state for roads and streets. The increase—plus local financial support—will permit a substantial rate of road and street improvement.

It is of interest that before final passage, Senate Bill no. 344 was amended to permit counties to impose an additional tax on motor vehicles for the support of rapid transit. In those counties which exercise this option, the state will collect the tax at the time of motor vehicle registration, in the form of a one half percent supplement to the two percent tax on vehicle values now being collected. If the added tax were imposed in the three counties now comprising the San Francisco Bay Area Rapid Transit District, about $4 million per year would be produced initially. If all nine counties were to exercise the option, about $8 million per year would be raised, with future proceeds increasing as motor vehicle registrations go up.

The road and street portion of the program is designed to do more than increase taxes. It will require the establishment of "select" systems of roads and streets, integrated with each other and with the state highways and freeways. The program will require that all new money be expended for rights-of-way and construction on the select system. It will require some local matching effort, and will impose some state

[31] Senate Bill no. 344, 1963 Regular Session.

supervision to assure that standards were being met. All in all, the program is designed to produce a "second level" system of roads and streets complementing the state highway system, to provide freeway connectors and laterals, and to give general traffic service. Notably, at least 40 percent of all traffic in the urban area is expected to be carried on conventional roads and streets under the jurisdiction of local governments, even if the ultimate in freeway development occurs. Thus, roads and streets seem destined to continue as major components of the Bay Area's transport system.

The Bay Area Rapid Transit System

Legislation enabling the creation of a rapid transit district in the Bay Area was passed by the state Legislature in 1949, but the district was not formed. In 1951, an amendment to the act created the San Francisco Bay Area Rapid Transit Commission. The commission subsequently undertook extensive preliminary studies, costing about $750,000, which led to the development of the rapid transit plan. These studies led also to a third round of legislation in 1957, producing a completely new act creating the San Francisco Bay Area Rapid Transit District. This is the district which is on the verge of building a transit system today.

Without tracing the intricacies of the district's history, it may be said that five counties were in the district at the outset—three are in it now. The system is outlined in the frontispiece map, which also shown possible future extensions.

The boards of supervisors of Marin and San Mateo counties withdrew their counties from the district. Marin County was forced out reluctantly when a special engineering board determined that it was not feasible to put transit trains on the Golden Gate Bridge. San Mateo County, already linked to San Francisco by rail commuter service, withdrew principally on grounds that costs of the new transit system in that area would exceed benefits.

In November 1962, the district, as reconstituted, won approval of a bond issue of $792 million with which to build its system. The schedule calls for construction to start in 1964, the first trains to run in 1966, and the whole (three-county) system to operate in 1971.

The Physical Facilities

For all practical purposes, what has begun is the design of an electric commuter railroad to serve interurban movements between and within three counties of the metropolitan area. While somewhat pepped up for popular consumption, the district's own description of the facility-to-be contains the essential details:

> Routes of the proposed system were carefully laid out to follow the Bay Region's most heavily used traffic corridors—to connect its cities and communities with an efficient new transportation link.
>
> The fast electric duorail lines will travel above, below and along the ground, depending upon local conditions of terrain and urban development.
>
> Included in the network will be 16 miles of subways and tunnels, 31 miles of gracefully designed aerial lines, and 24 miles of exclusive new surface lines—as well as a 4-mile-long underwater Trans-Bay transit tube.

Modern passenger stations, most of them equipped with parking facilities for thousands of automobiles, will be spaced along the entire regional network, close enough to provide convenient access, yet far enough apart to allow for high travel speeds.

Multi-level subways and underground pedestrian mezzanines will be located in down-town Oakland, Berkeley and San Francisco, where a high degree of urban development prohibits construction of less costly facilities.

The San Francisco subway line will be routed along Market Street, and then through the Mission District. A feature of the Market Street subway will be the provision of a separate underground level for San Francisco's existing streetcar lines. The rapid transit line will utilize the median strip of the new Southern Freeway, traveling southward to its planned terminus in Daly City.

Three transit lines will branch out from Oakland in the East Bay—north to Richmond [10 miles], east to Concord [15 miles], and south to Fremont [20 miles].

Some other details of the district were described, as follows:

Specially-designed lightweight electric trains will be developed.... They will be completely automatic, their operating controls governed entirely by a centrally-located electronic computer....

Varying from two to ten cars in length, the electric-powered trains will be virtually silent and vibration-free. Passenger facilities will provide the utmost in comfort and convenience, including spacious seats and aisles, pleasing interior colors, and temperature controls.

Rapid transit trains will travel at top speeds of more than 70 miles an hour. Schedule speed, including station stops, will be approximately 50 miles an hour....

Timetables will not be necessary, because trains will operate as often as every 90 seconds during peak hours, and no less frequently than every 15 minutes during the balance of the day.

Station stops will be limited to only 20 seconds, and a seat will be assured for every passenger.[32]

The Expected Benefits

The glow of this description of the physical facilities is rather well matched by the claims of benefits to the area:

Rapid transit can penetrate the heavily built-up urban centers with little or no usurpation of valuable land. It can provide its high-carrying capacity at far less total cost than can freeways and downtown parking space alone....

The principal function of regional rapid transit is to meet enough of the peak period demands so that the more costly alternative of relying solely on freeways and parking facilities can be avoided....

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[32] San Francisco Bay Area Rapid Transit District, *This Is Rapid Transit for the Bay Area* (folder), 1962.

The transit system has been designed to provide ease of movement throughout the region for the large number who do not have an automobile at their disposal, and to improve public transit service so that it will divert a much larger proportion of those travelers who can choose between automobile and transit. . . .

At the four gateways served by rapid transit, highway capacity deficiencies would be reduced from 22,400 persons per hour to 3,700 (in 1975) permitting a high standard of highway vehicular flow. In addition, rapid transit would divert 48,000 more work-day autos from city streets than does existing transit, and reduce central city parking requirements by 23,400 stalls. . . .

Internal traffic movement wholly within the urban core would also be improved by rapid transit. . . .

Thus, it is seen that much attention was given to the complementary function of the transit service. But the district's consultants concentrated on other benefits as well, in saying:

Rapid transit would help to preserve and expand the existing organization of urban and suburban areas, especially the advantageous concentration and specialization of employment in the core cities and regional subcenters. . . .

Rapid transit should not only stabilize existing property values, but also stimulate a substantial increase in them. . . .

Rapid transit would help to prevent disorganized urban sprawl with its destructive economic and social effects. . . .

Rapid transit would improve employment conditions. . . .

As "measurable" benefits, the district's consultant listed savings in travel time, accident costs, automobile insurance, parking charges, motor freight shipment costs, and traffic control costs; and came up with a 1975 figure of $51 million, compared with 1975 system costs of $42 million. In concluding the section on benefits, the consultant said:

With the great growth of population, employment, and travel which lies ahead for the Bay Area, the influence of rapid transit in establishing efficient travel patterns—and the system's large reserve capacity to absorb growing volumes of traffic into the foreseeable future—would make rapid transit an invaluable tool for aiding the area's economic growth, and for creating conditions for a high standard of metropolitan living.[33]

It is not the intention here to contest the claims made for rapid transit. Enough was said earlier to give some perspective to the place of rapid transit in the total Bay Area transportation picture. Perhaps the one negative point that has not been given adequate attention involves the feeder and transfer problem for the commuter or other transit user, who will be interested in comfort, and in the time required from door to door, not from transit station to station. On the positive side, the

[33] San Francisco Bay Area Rapid Transit District, *The Composite Report,* May 1962.

point that most appeals to this writer, and which gives a clarion tone to the ringing claims for the proposed transit system, is its large reserve capacity, and consequent ability to meet the potential demands of the long-range future. Transportation planning, and indeed general planning for the future, will be much concerned with this large capacity reserve. Whatever else may be said, however, the reserve will have been bought at great cost to the taxpayers.

Financing Rapid Transit

The key piece in financing the rapid transit system is the bond issue authorized by the district's voters in November 1962. This money will be used for system design, right-of-way acquisition, and construction. Payments of principal and interest on the general obligation bonds will be derived solely from *ad valorem* taxes on property in the district. A maximum tax rate of 67 cents per $100 of assessed valuation is envisioned. Debt service payments would begin in 1971–72 and continue through 1998–99. In all, $792 million in principal and perhaps $576 million in interest would be paid, a total of about $1.4 billion.

In earlier discussion, it was indicated that the transbay tube would be financed by the California Toll Bridge Authority. The total cost, with interest, was estimated at more than $201 million, of which $61 million would be repaid by the district, leaving a burden of about $140 million to be carried by bridge tolls. Together, property taxes and bridge tolls will provide about $1.5 billion. Presumably, any federal or state aids that might be secured would reduce these burdens, but, of course, would create others, however differently they might be spread.

Revenues of the system itself—collections from the fare-box, or, more accurately, the automated credit card and ticket system—will provide the remainder of the financing. Revenue bonds amounting to almost $73 million will be issued to acquire rolling stock, and will entail an additional cost of $43 million in interest. Transit revenues will also provide the wherewithal to repay the Toll Bridge Authority for the cost of approaches to the transbay tube. Finally, the revenues will, according to the estimates, meet operating and maintenance expenses, and provide funds for replacement and additions to equipment.

At no time has the district claimed that it would have a self-sufficient operation. The details of the proposed financing were carefully presented to the public, and were probably better understood than the physical make-up of the system itself. Thus the favorable vote, which produced a little more than the required majority of 60 percent, is a tribute to the persuasiveness of the district's supporters. At the same

time, the result attests to the seriousness with which urban transportation problems are regarded in this metropolitan area.

It is ironic that the district suffered its first real growing pains *after* the success of its bond issue. These have taken the form of taxpayers' suits and threatened legislation to change district boundaries and to give local governments a say in transit location. These matters have apparently been settled to the district's satsfaction, but not without serious slippage in its time schedules.

Some Transit Problems

The district, of course, will encounter more disenchantment as it attempts to turn picture into reality. Acquisition of properties for rights-of-way, stations, parking areas, will pose problems akin to those found in freeway building. The development of equitable and effective working arrangements with other transit operations, the Alameda-Contra Costa Transit District, the San Francisco Municipal Railway, etc., are challenges of the future.

Among the more important questions will be possible enlargement of the system. The authorized system has been regarded as only part of a first phase in rapid transit development. Will the district extend its services within the three counties? Will it expand into other counties? If the district proves its worth, affirmative replies would seem to be logical. But already there is talk of a private monorail operation for the Peninsula, as well as talk of a new West Bay Rapid Transit District. The Golden Gate Bridge and Highway District has been asked to consider the possibility of inaugurating a commuter operation. Whatever the individual merit of the many ideas now being advanced, they certainly do not simplify the development of a comprehensive transportation plan for the San Francisco Bay Area. But this is hardly dismaying—no one has ever suggested that the task will be easy.

Urban Transport and Technological Development

A generation that will see supersonic jets, and perhaps witness man's first moon flight, might expect something truly more spectacular than merely additional bridges, freeways, roads, and rails in its urban future. But the man in the street (literally) is likely to be disappointed, at least during the next 20 to 25 years.

Prediction of the practical future impact of new technological developments is a hazardous enterprise, at best. Certainly it is a foolhardy undertaking for one not trained in technology and without access to the inner sanctums of science. But the consensus suggests that we should not expect father's journey-to-work, son's trip-to-school, and mother's shopping expedition to take place by flying belt or pneumatic tube. It seems to say that our future automobiles—and our children's for some time to come—will be recognizable as lineal descendants of those we now have, albeit made with lighter materials, possibly of different sizes for different purposes, perhaps with new power systems and energy sources. It seems to say that the only meaningful difference between "monorail" and conventional "duorail" is one rail—the artful use of form and color take care of the rest.

It may be suggested that the scientific pace of today, along with the development of new analytical capabilities, makes innovation less of a random or unexpected occurrence than it used to be. Change in urban transport technology is likely to take place in comparatively small increments to existing systems. Components of systems, not total systems, are likely to undergo change. Stability will be the rule.

In an age of space exploration, the pace of urban transport development will seem glacial. This is no race to the moon with all rules suspended in the fire of competition and the flame of adventure. Economic reality, along with the political facts of life, will continue to play a leading role in the development of civil transport. Especially in the urban areas, the massive commitments of capital already made, both public and private, are not to be squandered for the sake of change.

Many of the most likely near-future developments in transport technology somehow seem to bypass the essence of the urban problem. The hydrofoil, the helicopter, the ground effects machine, are and will be too costly for the short trips typical of the urban area. The automobile, the bus, the train are expected to be the more efficient instruments for daily urban use. The exotic instruments are likely to find their major

uses in middle-distance transportation beyond the usual commuter range, where time savings are material enough to offset added costs. Their use within the urban area is likely to be limited to premium trips—from downtown to airports, between airports, for sightseeing, and for other non-diurnal movements.

At the other end of the spectrum—moving sidewalks, conveyors, and carveyors—travel slowly in the interests of comfort and safety. Their effective distances are severely limited, and are too short even for typical urban travel. Thus, their use will be found in special situations—in shopping malls, large parking areas, airport shuttles, and the like.

Thus the more novel instruments of transport are likely to be first adapted to the more novel demands of the urban area. Regularized travel will continue, for a generation or so, to depend on conventional modes.

The real improvements in urban transport technology are likely to take place within the systems themselves, and may be hardly visible to the user. For example, a more efficient means of fare collection may provide greater time savings than increases in train or bus speeds. New materials and construction methods may have considerable impact on transport costs, and may even change relationships between modes.

Automated traffic control systems for trains will provide greater safety and permit higher speeds. On the highways, improved traffic detection systems, air and television freeway surveillance, and computer applications to traffic flow problems may be expected to increase capacities of roadways and intersections, hopefully at a pace that will keep up with traffic growth. The beginnings of articulated and automated bus operations—on separate freeway lanes in some cases, on separate roadways in others—should be seen before many years pass. Operational guidance systems for private automobiles may be expected to take longer to develop.

Perhaps the greatest contribution of technology to the improvement of urban transport in the immediate future will be through the use of the high-speed electronic computer for data processing and analysis. The many transportation studies going on throughout the country place great emphasis on computer technology, so much so that one almost suspects the studies were designed for computer use rather than the computers adapted to study purpose.

The nature and problems of urban growth and development are being given a great deal of serious thought. There is an emerging understanding of the impact of transportation on land development, and the impact of land development on transport demands. Mathematical

models are being developed to improve our capabilities of predicting traffic generation, traffic distribution, and traffic flows. None of these models could be put to practical test and possible use without computer technology.

"Systems engineering" and "operations research" promise to enhance our capabilities for analyzing the metropolis and its transport requirements. More importantly, they open the doors to better informed planning for the future. This is not to say that calculus and computers will do our planning for us. But new methods and new machines *may* enable us to describe the major consequences of possible alternatives more clearly, and thus reduce the large areas of pure conjecture, to the end that more rational planning decisions will be reached.

Concluding Remarks

A major comprehensive transportation planning study for the San Francisco Bay Area would probably follow the lead of other recent studies and would encompass the following major elements:

1. A complete inventory of land uses and transport facilities in the study area.
2. Systematic forecasts of population, economic activities, land use requirements, spatial arrangements, and transport demands.
3. The preparation of alternative "sketch" plans of land use and transportation development for the area, accompanied by systematic description of the consequences of the alternatives.
4. Public deliberation of the alternatives to reach a consensus on the most desirable plan.
5. Testing and refinement of the plan, and development of a specific program to implement the original plan and conduct a "continuing planning process."

The technical aspect of the study would involve all the latest developments in data collection, processing, and analysis. These would include the development and use of economic, traffic, and land use models. Supporters of the study believe that a comprehensive transportation plan, soundly conceived, properly meshed with land use planning, and based upon reasonable public consensus, would be persuasive enough to bring about its own implementation through the chain reactions it will set in motion.[34]

But it is also recognized that achievement of a reasonable public consensus during the study and planning process—as well as its maintenance afterwards—will be no easy task in a metropolis as complex and diverse as the Bay Area. Thus, the proposal for the transportation study has given special attention to organization for the study.[35] A large policy committee of 37 members is provided, more than three fifths of whom will represent local governmental agencies in the area. It is hoped that broad and responsible participation in the study and planning process will bring about a reasonable consensus among the "decision makers" of the area, which will not only be persuasive as to federal and state agencies dealing with transportation but, more importantly, will be acceptable to the many counties, cities, and districts whose general support is vital to any kind of meaningful planning.

The policy committee for the study is specifically charged with de-

[34] California, University, Institute of Transportation and Traffic Engineering, *Summary Review of Major Metropolitan Area Transportation Studies in the United States;* by Richard M. Zettel and Richard R. Carll (Special Report), November 1962.

[35] Senate Bill no. 371, 1963 Regular Session.

veloping recommendations as to how the plan is to be implemented. These may include, of course, suggestions for reorganization or realignment of transportation functions in the Bay Area. The study will also probably suggest an appropriate transition to a permanent and continuing transportation planning process.

Any realist will recognize that the road ahead will be rocky. But the need for comprehensive planning on a metropolitan scale is undeniable: the alternative is no planning at all. The consequences of the latter, however much unknown or unappreciated, are nonetheless real. What is done by way of transportation planning and development in the next few years will tend to shape the Bay Area's development for the rest of this century. And the resulting physical configuration will largely determine whether the Bay Area will continue to be the delightful, prosperous, and stimulating community in which we and our children will wish to live.